Context and heterogeneity: A novel approach to explaining maternal health inequalities in Zambia

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Declaration of authorship

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I declare that my thesis consists of 59,003 words.

Abstract

Quantitative data from low- and middle-income countries show that inequalities in skilled birth attendance and health facility birth remain higher than inequalities in access to all other primary care interventions. Improving maternal health equity is increasingly prioritised in key policy, advocacy and accountability frameworks, such as the Global Strategy for Women's, Children's and Adolescents' Health, the Sustainable Development Goals, and Countdown to 2030. However, we lack theoretically grounded evidence on why inequalities in healthcare access and experience persist, without which effective policies cannot be developed. This thesis by papers demonstrates a novel approach to the empirical explanation of maternal health inequalities, using the case study of Zambia. This thesis' approach is rooted in social epidemiological, feminist, and sociological theories and makes use of mixed methods, including Bayesian multilevel modelling, interaction effects, decomposition, and analysis of in-depth interviews.

This thesis advances our understanding of inequalities by theorising, measuring, and analysing the context in which individuals operate, instead of essentialising individual-level characteristics. Using multilevel models, I analyse the power of multidimensional health service environments to predict access to a health facility birth in Paper 1[1]. Rather than solely defining the context geographically, I combine geographic characteristics (distance to any health facility, to a midwife, and/or to a hospital capable of conducting Caesarean sections) with social characteristics we know are discriminated against in the Zambian health system (being poor, having many children). I find that multidimensional health service environments have high discriminatory accuracy in the Zambian context. Social context is further explored in Paper 3[2], which analyses the role of social exclusion, shame and stigma in shaping women's experiences of pregnancy and childbirth, particularly in their relationship with the health facility. I demonstrate that health facility rules play a key role in perpetuating social exclusion and reinforcing unequal power relations, both between patients and health workers, and among patients themselves. Paper 4 uses decomposition analysis to explore the extent to which health service environments are unequally distributed across more vs. less advantaged groups. I show that these environments explain a large share of socio-economic inequalities.

This thesis also critically examines the assumption that policies, environments and individual characteristics have the same meaning and effect for different socio-economic groups. In Paper 2[3], I explore whether the association between facing a specific healthcare access barrier and having a facility birth differs according to how many other barriers a person faces. I find that for three out of the six barriers defined, the association is weaker the more other barriers are present. I theorise the implication of this finding for policies that seek to remove one barrier at a time in order to reduce inequalities and propose and formalise a new hypothesis I call: "The Concurrent Barrier Hypothesis". In Paper 3[2], I show that while facility rules can be unequally applied, social exclusion works more strongly through "institutional bias", in that the rules are harder to follow for women with fewer economic or social resources. In Paper 4, I use Kitagawa-Oaxaca-Blinder decomposition to investigate whether health service environments and individual or household attributes have different effects on

[1] Sochas, L. (2020). The predictive power of health system environments: a novel approach to explaining inequalities in maternal healthcare access. BMJ Global Health, 4. https://gh.bmj.com/content/4/Suppl_5/e002139.info

[2] Sochas, L. (2019). Women who break the rules: Social exclusion and inequities in pregnancy and childbirth experiences in Zambia. Social Science & Medicine, 232, 278–288. https://doi.org/10.1016/j.socscimed.2019.05.013

[3] Under review in World Development - Submitted 2nd April 2020

access to facility birth depending on socio-economic status. I find that many individual characteristics (such as marital status, autonomy, and employment) have contradictory meanings across different socio-economic groups.

This thesis not only contributes to the field of global health empirically, but brings a number of conceptual contributions by (1) Modelling an abstract and multidimensional social structure using random effects; (2) Developing and testing a new hypothesis on the unintended consequences of assumed pro-equity health policies; (3) Suggesting that the global discourse around disrespectful maternity care should be modified to include routine practices such as health facility rules; and (4) Proposing a novel empirical approach for quantitative researchers of global health inequalities to avoid "categorical thinking" (the practice of treating social categories as de-contextualised, natural, and internally homogeneous). The thesis concludes that the manner in which we conduct research matters for the policy and politics of maternal health, particularly from a social justice perspective.

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This thesis is dedicated to my French grandmother Jeannette, who passed away in 2019. I knew her as a shrewd and impish woman, who loved to spoil her grand-children and great-grand-children. She experienced similar injustices to those alluded to in this thesis: suffering the death of an infant child, losing her sister to pregnancy complications, and living in a religious and patriarchal society that denied her the freedom to choose a secondary education or the size of her family and doubted her ability to run a farm without a husband. She had a fighting spirit, and I will always cherish memories of our time together.

À ma grand-mère Jeannette

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Chapter 1: Introduction

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1. Motivation

1.1. A grave inequity

"From out of her blouse, Sakina produced one pair of gloves and a single folded kanga. "Is this all?" demanded the midwife, "Where are the rest?" Sakina turned her face down, a response that elicited a barrage of scolding: How could this mama be so irresponsible? Surely she was told to get the vifaa[4] *ready, but no, this mama could not be bothered. Disobedient and lazy, that's what she was. […] The midwife's response: "She can deliver here when you find the vifaa. Until then, she can wait."* (Spangler, 2011, p. 485)

"They [health workers] get upset. They get upset, from the time you get pregnant until you give birth, can you lack even one coin, can't you surely keep that same coin if you see that my man is not serious with what he is doing." [04-10-02] (Paper 3 of this thesis)

These two quotes illustrate one facet of inequities in maternal health: the moralisation, shame, and social exclusion that might discourage poor women from accessing a facility birth or could result in mistreatment if they do access care. Maternal healthcare access, particularly access to skilled birth attendance, remains the most unequal of all primary healthcare access indicators within Low and Middle-Income Countries (LMICs), across both absolute and relative measures of inequality (Barros et al., 2012; Boerma et al., 2018; Victora et al., 2016). A commonly offered explanation in the literature is that skilled care in childbirth requires a complex health system and cannot usually be delivered at the community level, unlike interventions such as oral rehydration salts or vaccines (Barros et al., 2012; Victora et al., 2016).

There is also huge variation in levels of maternal health worldwide, with maternal mortality one of the most unequal health indicators across countries. In 2015, the maternal mortality ratio (MMR) in the Sub-Saharan African (SSA) region was estimated at 566 deaths per 100,000 live births, more than 50 times higher than the MMR of 11 in High-Income Countries (HICs) (WHO et al., 2019). The disparity is even larger when presented as lifetime risk of maternal death (which also considers fertility patterns), with the estimated risk for SSA being 130 times that of HICs (Graham et al., 2016). There is also very wide variation within Sub-Saharan Africa, from an estimated MMR of 119 in South Africa, to 1,150 in South Sudan (WHO et al., 2019). Relative inequalities between countries with the highest and lowest MMRs (ratio) worldwide have increased over time, from around 100 times difference in the 1990s to over 200 times difference in 2013, though absolute differences have decreased (Graham et al., 2016).

The scale of these intra- and inter-country inequalities establishes that maternal deaths are avoidable, including in LMICs, and therefore that differences in maternal health outcomes and healthcare are unfair and inequitable (Whitehead, 1991). Redressing these inequities is a moral imperative.

1.2. A policy puzzle

While health equity has been a policy focus of the global health community since at least the Alma-Ata Declaration of 1978 and the Global Strategy of Health for All in 1981, the Millennium Development Goals adopted in 2000 made no mention of reducing health inequalities (Hosseinpoor et al., 2015). This was driven by an assumption that "all mothers and children in low-income and middle-income

[4] *"Vifaa, Swahili for "things," refers to the collection of items providers required women to bring for delivery at health facilities." (Spangler, 2011, 485)*

countries were equally poor" (Victora et al., 2012, p. 1153). Only since 2010 has there been a renewed policy focus on reducing reproductive, maternal, neonatal and child health (RMNCH) inequalities in LMICs. This is evident in calls by the 2010 Commission on Information and Accountability for Women and Children's Health to disaggregate data by gender and equity dimensions. The Countdown to 2015 initiative described inequalities in child health as early as 2005 and started producing country equity profiles by 2010 (Victora et al., 2016). Beyond RMNCH, this attention to health inequalities was promoted by the 2008 Commission on the Social Determinants of Health and the 2011 Rio Political Declaration on the Social Determinants on Health (Hosseinpoor et al., 2015). The global health sector's and governments' focus on health inequalities is much clearer today, with the Sustainable Development Goals including a specific target on universal health coverage.

Government policies to reduce maternal health inequalities are necessary, because the balance of evidence indicates that there is no monotonic decrease in absolute inequalities as average coverage increases. On the one hand, the majority of LMICs with available data experienced an increase in overall SBA coverage (1 p.p. annually) over the period 1995-2013, which coincided with a (slow) decrease in the absolute inequality of access to skilled birth attendance (SBA) (<0.5 p.p. annually) (Hosseinpoor et al., 2015). However, this pattern hides substantial variability. Over a similar time period, there is an inverse-U relationship between average levels of facility delivery in the population and absolute inequalities in facility delivery by wealth quintiles and urban-rural residence (Channon et al., 2012; Victora et al., 2018)[5]. This pattern implies, consistent with the Inverse Equity Hypothesis (Section 6.1), that initial improvements in coverage are concentrated in the richer wealth quintiles. After a while, poorer wealth quintiles catch up, reducing inequalities. Even within this pattern, there is variability. Slow (or negative) increases in SBA coverage are pro-rich on average, moderate increases in national coverage privilege the 3rd and 4th richest quintiles, while rapid increases in national coverage privilege the poorest quintiles on average (Victora et al., 2012). Countries with similar levels of average coverage for SBA also have vastly different inequity levels (Barros et al., 2012). Overall, the available evidence indicates that adopting a trickle-down approach to inequalities in maternal healthcare access by simply focusing on improving average levels of coverage is not guaranteed to reduce absolute inequalities. There are many different pathways to universal coverage, only some of which are characterised by "progressive universalism", whereby gains in average levels of healthcare access are achieved by expanding coverage for the most disadvantaged first (Gwatkin and Ergo, 2011).

Thus, there is a moral imperative to reduce inequities in maternal health between and within countries; this moral imperative aligns with current global policy priorities; and specific actions from the state are likely to be necessary to reduce maternal health inequities. Unfortunately, we still have limited information on what policies, exactly, are effective. A 2014 systematic review of studies evaluating interventions to reduce maternal and child health inequalities in LMICs found great variation: interventions can increase, decrease or fail to impact health or healthcare inequalities defined according to wealth, education, ethnicity, gender, and other dimensions (Yuan et al., 2014).

Efforts to prioritise greater coverage for the most disadvantaged have had mixed results. Yuan et al. (2014) found that 23/42 studies reported that the intervention had improved equity, while 15/42 found no or negative effects on equity. Mixed results are also reported within interventions. The abolition of user fees had pro-poor effects on maternal healthcare utilisation in Ghana's Brong Ahafo region, in Uganda, in Benin, in a multi-country analysis of Ghana and Burkina Faso, and in a multi-country analysis of Mali and Benin (Dzakpasu et al., 2012; Leone et al., 2016; Nabyonga-Orem et al.,

[5] The pattern for relative inequalities is different: increases in coverage are associated with a monotonic decrease in relative inequalities in SBA, measured by the concentration index (Victora et al., 2018).

2005; Ravit et al., 2018). In contrast, user fees removal or the introduction of social insurance was found to have a null or negative impact on equity of access to facility delivery or Caesarean sections in Zambia, in Ghana as a whole, and in Ghana's Volta and Central regions, in Benin, and in a multi-country study of Ghana, Senegal and Sierra Leone (Dossou et al., 2017; Johnson et al., 2016; Lépine et al., 2017; McKinnon et al., 2015a; Penfold et al., 2007). Results for demand-side financing interventions are also contradictory. Vouchers and conditional cash transfers had positive equity effect in Bangladesh and India respectively (Keya et al., 2018; Målqvist et al., 2013; Yuan et al., 2014). However, null or negative equity effects were observed for targeted subsidies in rural Burkina Faso, for Zambia's unconditional cash transfer programme, for vouchers in Pakistan and India, for conditional cash transfers in Mexico, and for means-based exemptions in Tanzania (De Allegri et al., 2012; Handa et al., 2016; Kuwawenaruwa et al., 2016; Målqvist et al., 2013).

Some of these contradictory findings could be explained by these studies' different methods, which range from simple before-after comparisons to designs permitting causal inference (Dzakpasu et al., 2014; Lagarde and Palmer, 2011). Other contradictory findings across countries or regions might be explained by varying levels of implementation success (Ridde and Morestin, 2011). A third hypothesis, which motivates this thesis, is that these policies do not always appropriately target the main drivers of inequality, because there are serious limitations in how we study and understand inequalities in maternal health.

2. How we study the determinants of - and inequalities in - maternal health

2.1. Data limitations in studying maternal health outcomes

The end goal of maternal health policies, in line with the human right to health (UN, 2000), is to reduce inequalities in maternal health outcomes, rather than maternal healthcare access. However, most studies and evidence on intra-country maternal health inequalities pertain to inequalities in healthcare access, not outcomes. A major reason for this is the great difficulty of linking maternal mortality data to socio-economic status. Most LMICs lack a complete Civil Registration and Vital Statistics (CRVS) system to accurately record all maternal deaths in the country. Even in places where it is available, maternal deaths are likely to be under-reported (cause of death wrongly attributed to another cause) (Merdad et al., 2013), and deaths are more likely to be reported in wealthier areas with better access to medical certification and more incentives to engage with state officials. Not all CRVS systems document socio-economic status (SES) or permit data linkage with SES: for example, many European CRVS do not have this capability (Mackenbach et al., 2017).

Surveys such as the Demographic Health Surveys (DHS) ask questions about maternal deaths to surviving siblings, but maternal death remains a relatively rare event that is difficult to accurately estimate using survey data for the population as a whole, let alone for smaller socio-economic groups. The SES of the deceased sibling is not available and must be assumed based on the SES of the surviving sibling (Graham et al., 2004). Cause of death is likely to be inaccurate given recall periods and the lack of medical certification. Global estimates of country-level mortality do not take survey-based estimates as given, but rather include them as data points in Bayesian models adjusted for skilled birth attendance, fertility rates, and GDP per capita (WHO et al., 2019). Such models have yet to be developed for inequalities in maternal mortality.

Another option has been to analyse data on inequalities in maternal mortality from census data. A study based on the 2010 Zambian census, for example, estimates the pregnancy-related mortality

ratio in rural areas to be 960 deaths per 100,000 live births, compared to only 470 in urban areas (Banda et al., 2015). The average MMR estimate from this study, however, is much higher than both DHS and UN estimates, even after accounting for the difference between maternal mortality and pregnancy-related mortality. While estimates from the census have the advantage of universal sampling relative to surveys, they are also vulnerable to misclassification or incorrect recall, and new census estimates are only produced every 10 years. Validation studies have noted both over- and under-reporting (Hill and Stanton, 2011). Furthermore, they do not always collect sufficient (or any) information on assets to enable an analysis by wealth ("IPUMS International Harmonized variables," n.d.).

Data on other maternal health outcomes, such as morbidities, are even less widely available in LMICs, although special surveys and qualitative data do document inequalities in maternal morbidities (Graham et al., 2016; Lange et al., 2019). There is even less data on "positive" health outcomes such as maternal wellbeing or physical functioning, despite "health" being defined by the World Health Organisation (WHO) as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1946). Though the disrespectful maternity care literature is concerned with mental and social wellbeing, it is very limited in the behaviours and systems it has labelled as problematic for women's wellbeing (Paper 3 of this thesis). A popular alternative to studying inequalities in maternal health outcomes is to study inequalities in early neonatal mortality (0-6 days), from DHS or Multiple Indicator Cluster Surveys (MICS) survey data. Maternal complications are present in the vast majority of stillbirths or early neonatal deaths (Vogel et al., 2014). However, neonatal deaths may be under-reported in surveys or may be misreported as stillbirths, particularly if the death occurred shortly after delivery. Estimates have wide confidence intervals, making it difficult to compare levels across sub-population groups (Neal, 2012).

2.2. The case for facility-based birth

Given the lack of reliable data on inequalities in maternal health outcomes, and the need to proxy for health outcomes using data on healthcare access, I will briefly describe the scientific consensus regarding the link between maternal healthcare access and maternal and neonatal survival. The Lancet series on Maternal Survival in 2006 placed a strong emphasis on the intrapartum period as the most critical stage of the continuum of care for maternal survival (Campbell and Graham, 2006). The argument is that most maternal deaths occur during labour, birth, and in the 24 hours postpartum, and that the risk of maternal complications cannot be sufficiently well identified or treated in antenatal care (Carroli et al., 2001). Regarding place of birth, it was strongly advocated that women in LMICs should deliver in a facility capable of providing Basic Emergency Obstetric and Neonatal Care[6] (BEMONC) with midwives as their main providers, but with an effective referral pathway to a hospital capable of providing CEMONC-level[4] care (Campbell and Graham, 2006). This set-up supports normal birth and avoids risks of over-medicalisation (Renfrew et al., 2014), while also being of adequate quality to respond to obstetric complications should they arise. It is also less costly and guarantees better referral pathways than systems that encourage home births with skilled birth attendants for "uncomplicated" cases. Evidence does not support trained traditional birth attendants as an effective

[6] A BEMONC facility is able to provide 7 signal functions: Administer parenteral antibiotics; Administer uterotonic drugs; Administer parenteral anticonvulsants for pre- eclampsia and eclampsia; Manually remove the placenta; Remove retained products; Perform assisted vaginal delivery; Perform basic neonatal resuscitation. A Comprehensive Emergency Obstetric and Neonatal Care facility can provide the signal functions listed above as well as surgery (C-section) and blood transfusion.

strategy to reduce maternal mortality (Campbell and Graham, 2006). This emphasis on facility birth has been maintained in the 2016 Lancet Series on Maternal Health (Miller et al., 2016).

The link between facility delivery and maternal and neonatal survival is problematic in practice. The latest Lancet Maternal Health series reflects a renewed focus on quality of care, acknowledging that only quality care is capable of guaranteeing good maternal health outcomes (Austin et al., 2014; Graham et al., 2016). Across 72 LMICs (mostly post-2000), inequalities in access to facility delivery (by education and wealth) are much larger than inequalities in early neonatal mortality (0 to 6 days). This finding points to richer mothers failing to translate their privileged access to maternal healthcare into a neonatal survival advantage, because of low quality of maternal healthcare in facilities (Lohela et al., 2019). There is likely to be significant variation in the survival effect of facility delivery across settings. While direct maternal mortality (measured in the census) was strongly associated with distance from the nearest hospital in Tanzania (Hanson et al., 2015), neonatal mortality (measured in the DHS) was not associated with distance and signal functions in Malawi and Zambia (Lohela et al., 2012).

2.3. Popular levels of explanation: woman, husband, household, community

The majority of quantitative evidence on the determinants of maternal healthcare access focused, until relatively recently, on individual or household determinants of access. In Gabrysch and Campbell's (2009) comprehensive review of this topic, the variables "frequently included" in quantitative analyses of the determinants of healthcare access were: maternal age; ethnicity, religion, traditional beliefs (sic); mother's education; birth order; ability to pay; and region, urban/rural. Region and urban/rural residence are the only variables in this list that are not conceptualised at the individual level. However, they remain a black box since other types of regional variables are typically not included to explain their effect.

This broad conclusion is supported by a more recent review conducted by Moyer and Mustafa (2013) in the context of Sub-Saharan Africa specifically. The focus on the mother's characteristics has also occasionally been complemented by including husband or household characteristics to take into account other (and potentially more powerful) decision-makers. The community-level has also been incorporated into some analyses, particularly as it relates to community-level norms about fertility or reproductive healthcare, average levels of education, wealth or autonomy, or access to media (Babalola and Fatusi, 2009; Levira et al., 2014; Stephenson et al., 2006).

2.4. Since 2010, more attention to health service context

Quantitative studies that include the health service environment as a determinant of facility birth by considering distance or time of travel, cost, acceptability, administrative accessibility, or quality of care are much rarer and can present severe limitations. A recent review of quantitative, Sub-Saharan African studies that included time of travel and/or distance to care as a predictor of facility delivery found that only 8/57 were conducted at a national scale and that just over half measured distance according to respondents' self-reports (Wong et al., 2017). Respondents may not all be able to accurately report distance or travel time or may themselves experience different travel times depending on what transport is available on a specific occasion. The highest quality data (and highest response rates) would be expected to come from those who have accessed care, which is likely to introduce bias. Small samples or narrow geographical coverage can also result in insufficient variation in the health service environment variables (Gabrysch and Campbell, 2009).

By contrast, linking DHS data to health facility lists through Geographic Information Systems (GIS) enables the inclusion of externally measured variables at the health service environment level while

still having wide geographic reach (Gabrysch et al., 2011). These approaches are still relatively new. As of 2011, only 3% of articles examining the determinants of facility delivery in Sub-Saharan Africa included any GIS information (Moyer and Mustafa, 2013). Two thirds of the 57 studies included in Wong et al.'s review (2017) were published after 2010. While the use of GIS in maternal health research is rapidly growing (Ebener et al., 2015; Makanga et al., 2016; Matthews et al., 2019), many studies focus on specific health service barriers, particularly distance and/or quality of care, instead of considering the health service environment as a whole. Two recent studies model the effect of travel time to the nearest health facility (or hospital) on access to facility delivery across multiple East African countries using advanced GIS techniques that account for the road network, bodies of water, land surface, and slope to create "impedance" surfaces (Ruktanonchai et al., 2016; Wong et al., 2020). Wong et al. (2020) additionally include an interaction term between travel time and wealth, which is highly significant in all four study countries.

2.5. Limited attention paid to explaining maternal health inequalities

Most quantitative studies of maternal healthcare access seek to uncover the determinants of facility delivery, and thereby describe rather than explain inequalities. For example, while it is widely acknowledged that poor, uneducated, or rural women are less likely to access a facility delivery across most LMIC settings, most epidemiological studies do not empirically examine why this might be the case.

Explanation requires theory to guide enquiry. Health inequality scholars typically studying a broad range of health outcomes in mainly high-income countries, have repeatedly called out the lack of theories in public health and epidemiology (Bauer, 2014; Choo and Ferree, 2010; Hammarström and Hensing, 2018; Krieger, 2001, 1994; Øversveen et al., 2017). This critique has also been made in the global health literature (Adams et al., 2019).

Theory-based hypotheses about SES inequalities (or other types of inequalities) could be quantitatively tested in a simple multi-variable regression framework. Theory can guide the sequential inclusion of potential explanatory variables into the model, observing changes in the strength and coefficient of the SES variable. Mixed methods can also be used to uncover underlying mechanisms, as demonstrated by Spangler and Bloom (2010) in their Tanzanian study.

A specific variable contributes to explaining inequalities in facility delivery if it is associated with facility delivery and if it is differentially distributed across the groups whose average difference in access we are trying to explain. One limitation of the regression framework is that it does not report on the differential distribution of the determinants across different population groups, and nor does it quantify the contribution of each determinant to explaining inequalities[7]. Decomposition analyses, however, do provide this information and are extremely useful for explaining health inequalities (O'Donnell et al., 2003). However, many such decompositions in the maternal health literature are not guided by theory, rely exclusively on individual or household attributes, and either do not take the health service environment into account, or proxy for it using unreliable variables on self-declared access problems.

[7] However, one can still draw conclusions about the distribution of a given determinant across population groups in a regression framework. Including a new exploratory variable evenly distributed in rural and urban groups would not change the association of rural residence with facility delivery such that we could conclude that this new variable did not explain the association between rural residence and facility delivery.

3. How we study maternal health inequalities matters

Critical theorists remind us that how we frame our research questions (and represent policy problems), as well as the variables and categories we use to do so, is socially constructed and has political effects (Bacchi, 2013; Greenhalgh, 1996). This section reviews each of the points made above regarding the broad orientations of the maternal health literature and discusses its policy and political effects. This includes: (1) Outcomes of interest (2) Levels of analysis (3) Use of theory.

3.1. Limited outcomes

The choice of outcomes is not simply one of convenience or validity. It fundamentally shapes how we understand a problem and what we propose to do about it, especially in a policy-oriented field such as maternal health (Adams, 2016). For example, the field's emphasis on evaluating progress by using the maternal mortality ratio has led the maternal health community to focus on addressing severe maternal complications (Graham and Campbell, 1992). In this conceptualisation, maternal health is predominantly physical and negative, despite the WHO's broader definition of health (WHO, 1946). Obstetric signal functions are prioritised and much less attention is paid to treating or preventing maternal morbidities, which may require a different kind of surgery than caesarean section (e.g.: fistulas), long-term management beyond the postpartum phase (e.g.: anaemia), or more attention to chronic conditions (Filippi et al., 2018; Storeng and Béhague, 2017).

Similarly, the field's focus on increasing rates of facility delivery combined with its lack of concern for maternal wellbeing has led to punitive actions, where women who already suffer from social exclusion are fined or stigmatised for not delivering in a health facility. This has been documented in a wide range of settings, including Burkina Faso, Nicaragua, Malawi, Tanzania, and Zambia (Chimhutu et al., 2014; de Kok, 2019; Greeson et al., 2016; Kvernflaten, 2013; Lodenstein et al., 2018; Melberg et al., 2016). Others have argued that the focus on improving rates of facility delivery and "skilled" birth attendance has led to the unethical situation of women being encouraged to deliver in facilities, and with providers, that are unable to provide quality care (Graham et al., 2016; Storeng and Béhague, 2017; Van Lerberghe et al., 2014).

Given the powerful policy implications of outcomes and indicators, *who* get to decide the outcome of interest, and whether there should be consensus on a small number of "important" outcomes or diversity of outcomes, matters greatly (Olivier de Sardan et al., 2017; Storeng and Béhague, 2017; Valles, 2018). Others have warned unequitable or non-participatory systems for reaching consensus has led to a "*dangerous disconnect between the way the global health community has framed problems, proposed strategies, and pushed solutions, and the lived experience of people and providers*" (Freedman, 2016, p. 2068).

3.2. Levels of analysis

The level at which we situate explanation fundamentally shapes our understanding of *what* needs to change and therefore *who* is responsible for change: women themselves, their family, their household, their community, the health service environment, those who hold power in a globally connected society? It is a political rather than a technical choice (Lofters and O'Campo, 2012; O'Campo and Dunn, 2012). James Young (1981), quoted in Spangler and Bloom (2010), argues:

> *"…there exists a potential for disservice to the people we study when cultural barriers to the acceptance and use of Western medicine are emphasized to the exclusion of any concern with the role that externally derived economic and organizational constraints also play in decision-making. Tradition focused explanations tend to put responsibility for under-use with the people and their*

way of life, rather than with the unequal manner in which modern medical services are made available to the poor and politically powerless" (p. 506)

In the maternal health literature specifically, an exclusive focus on individuals and communities can lead to "blaming the victim" (Gabrysch and Campbell, 2009), diverting attention from the importance of state action. Further up the causal chain, anti-colonial scholars question the lack of inclusion of macro-determinants, such as global economic exploitation, in analyses (Kumar, 2013). "Blaming the victim" is not only ineffective in terms of redressing inequalities (Bauer, 2014), but also has representational effects, attacking those with less power in their self-image and contributing to shame and social exclusion (Kabeer, 2000; Van Hollen, 2003).

In the Zambian context, a study based on a special survey of recently delivered women provides a recent example of the power of analytical levels. It demonstrates an association between whether women saved during pregnancy to cover delivery costs, and the odds of facility delivery (Chiu et al., 2019). While their analysis is sound, the authors' main recommendation is to implement awareness-raising initiatives about the importance of saving during pregnancy (e.g.: as opposed to policies that would make accessing pregnancy less costly). While their findings cannot be used as a basis to recommend one policy over another aimed at alleviating affordability problems, it is probable that their recommendation is influenced by their level (and topic) of analysis.

This historical focus on individual, household and community-level determinants rather than on the health service environment is likely related to the fact that Demographic Health Surveys, the most widely available datasets on maternal healthcare access, collect data from individuals, not facilities (Gabrysch and Campbell, 2009). Many countries' geo-referenced national health facility lists are still not available online, although this is evolving (Wong et al., 2020). Even when they are available, most facility lists do not have data on staffing levels, quality of care, staff attitudes, or costs (many of which will be informal). The enormous foreign investment in the production of the Demographic Health Surveys rather than health facility lists or the Health Management Information System (HMIS) also likely reflects political priorities regarding where action should be taken, and whose needs the data are meeting (Storeng and Béhague, 2017).

3.3. The importance of theory

The importance of theory lies in the way it makes visible the assumptions underlying the analysis, precisely because a-theoretical research is not objective or value-free. *"Even without an explicit theoretical frame, we impose meaning in ways that determine how we describe, interpret and seek to effect change in the world around us."* (Sigle, 2016). Theory-based research is thereby more transparent and improves the quality of debate. Secondly, given the way in which it organises and guides research, there is an effectiveness argument to be made about the use of theory. "*By making conscious use of epidemiological theory and having informed debates over the different theoretical perspectives in play we stand a better chance of producing epidemiological knowledge truly useful for preventing disease, promoting health equity and improving people's health."*(Krieger, 2011 cited in Hammarstrom & Hensing 2018). Theory postulates a causal process behind the creation of health inequalities. If shown to be correct, this causal process can be disrupted by policies or political change in order to reduce inequalities (Bauer, 2014; Evans, 2019a).

Building on these two points, a-theoretical research that exclusively describes difference without considering explanations for inequality can be actively harmful for social justice and the reduction of health inequalities. Firstly, it can serve to entrench the inevitable nature of inequalities (Bauer, 2014). Secondly, it can result in essentialising difference, by implicitly ascribing the cause of inequalities to

the people inhabiting the disadvantaged social position (Adams et al., 2019), a line of reasoning that also implies the absence of the potential for change over time. It is possible to use theory in descriptive work, by using theoretical frameworks to interpret findings (Evans, 2019a). For example, Evans (2017) interprets health inequalities in line with intersectionality theory, i.e. as inequities resulting from mutually constitutive power relationships at the macro level, which find expression in a wide range of institutions and inter-personal relationships at all levels of society.

4. A new approach to explaining maternal health inequalities

In this thesis, I develop novel ways of explaining maternal health inequalities in order to inform policy responses aiming for social justice, by engaging with the concerns outlined above (theory, levels of analysis, outcomes) across four empirical papers.

4.1. Grounding in theory

I use theory to explore heterogeneity as a fundamental feature of the underlying causal pathway for maternal health inequalities. In Paper 2, I develop a theory building on Fundamental Causes Theory and the Inverse Equity Hypothesis[8] to ask whether policies removing a barrier to healthcare access (e.g. by removing user fees) might benefit the most privileged. In Paper 3, I investigate institutional bias in health facility rules, based on an analytical framework of social exclusion by Naila Kabeer (2000). I ask whether rules for women's behaviour in pregnancy and childbirth have different effects on women's experiences depending on their financial and social resources. In Paper 4, I draw on intersectionality theory to challenge categorical thinking in health inequalities research, the practice of treating social categories as homogeneous, natural, and un-contextualised.

4.2. Multiple levels of analysis

Inspired by the multi-level perspective of "eco-social" social epidemiology frameworks (Krieger, 2001), and intersectionality theory (Choo and Ferree, 2010), this thesis explores the importance of the meso-level healthcare context by centring the health service environment as the main explanatory variable. Paper 1 develops and evaluates a "relational" healthcare accessibility framework, which explicitly defines healthcare access barriers as the gap between the population's needs and the supply, nature, and distribution of health services. This framework puts the onus of change on the health system, and not the people it is meant to serve. This relational healthcare access framework is used to frame further analyses exploring mechanisms behind health inequities in Paper 2 and 4. In Paper 4, I additionally consider the role of the macro-level context of unequal power relations between colonising and colonised states and peoples, between men and women, and between rich and poor.

4.3. Diversity of outcomes

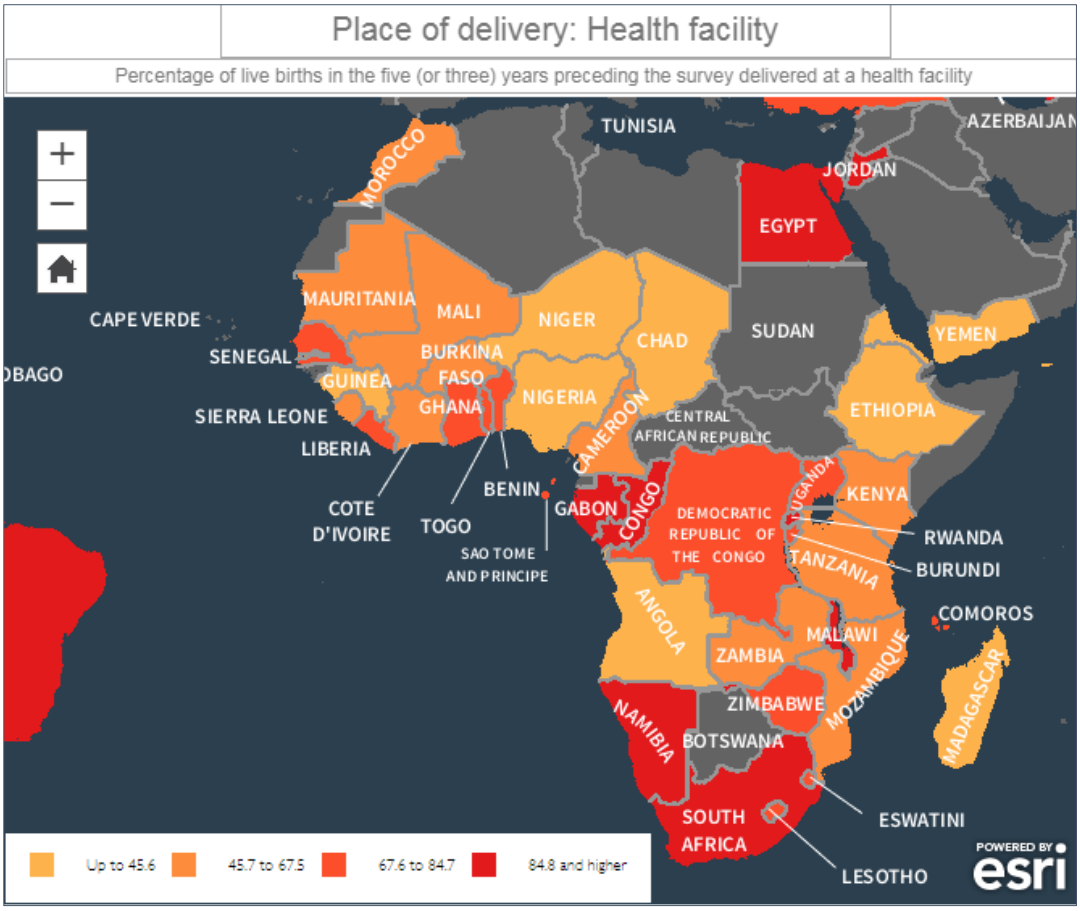
I complement three of the papers' focus on access to facility delivery with a qualitative paper, Paper 3, that focuses on women's experiences in pregnancy and childbirth as the main outcome of interest. I interpret this paper's results in light of the international and national focus on facility delivery as an indicator of success. While this paper does not constitute participatory action research, which would have been more effective at highlighting outcomes that are important to pregnant or birthing women (or Zambian society more broadly), the results stemming from its exploratory design question the established framing of "disrespectful care" in maternal health policy and research.

[8] Both are instances of a "political economy approach" to health inequalities (Krieger, 2001).

5. Zambia as study context

In this section I introduce the setting for this study, Zambia, and explain its selection. SSA bears a disproportionate share of the burden of poor maternal health, with 66% of maternal deaths worldwide in 2015 (Alkema et al., 2016). Zambia is a lower-middle income country with a Total Fertility Rate (TFR) of 5.3 over the period of study[9] (Central Statistical Office (CSO) [Zambia] et al., 2014). At 232 deaths per 100,000 live births, Zambia has fairly low levels of maternal mortality compared to the Sub-Saharan African average (566 deaths per 100,000 live births in 2015) (WHO et al., 2019). 67.4% of women gave birth in health facilities between 2008 and 2013 (Central Statistical Office (CSO) [Zambia] et al., 2014), a medium level for the region (Figure 1). Evans' (2018a) ethnographic study of the prioritisation of maternal health indicators within the Zambian health system demonstrates in detail how downward accountability structures, rooted in global pressures to achieve targets, have driven progress in improving average levels of maternal healthcare access and reducing maternal mortality.

Figure 1: Health facility delivery by country in Sub-Saharan Africa, most recent DHS



***Source**: Statcompiler.com, accessed 5th May 2019*

Zambia was selected as the country context for this thesis because while it has made progress in increasing average levels of access to maternal healthcare (and in reducing maternal mortality), inequalities remain high. The absolute difference between facility delivery rates in the richest vs. poorest wealth quintiles was nearly 50 percentage points over the 2008-2013 period (Central Statistical Office (CSO) [Zambia] et al., 2014), a much larger disparity than differences in access to child

[9] This section describes Zambia over the period covered by the quantitative data used in this analysis: 2008-2014. In January 2020, a new Demographic Survey was released, covering the period 2013-2018. The results of the most recent DHS are briefly described in the conclusion.

immunisation (Assaf and Pullum, 2016) (Figure 2). The Government of Zambia has made it a priority to reduce inequalities in its National Health Strategic Plans (Republic of Zambia Ministry of Health, 2017, 2011, 2005), and many health and health-related reforms have been initiated in Zambia over the past ten years with health inequalities reduction in mind. For example, strategies have included building 650 new health posts; promoting community-level Safe Motherhood Action Groups (SMAGs) that operate in conjunction with community health workers trained to facilitate and encourage facility delivery; abolishing user fees; building maternity waiting homes; and providing unconditional cash transfers for children, the elderly and the disabled. The sociological literature on Zambia suggests that at least three types of unequal power relations may be structuring maternal health inequalities: between genders, between the poor and the rich, and between formerly colonized and (neo-)colonial states. These domains are all highly relevant to people's lived experience in Zambia, are in flux, and mutually affect each other (Cole et al., 2015; Evans, 2014a; Phiri and Abebe, 2016).

Zambia has geo-referenced data on both maternal healthcare access and health facility infrastructure and staffing, making it possible to operationalise a relational model of healthcare access (Section 7). Figure 3 shows which areas of Zambia the papers in this thesis focus on. The qualitative fieldwork district, Mansa district, was not covered by SARA data, though a neighbouring district, Samfya, was. Additional information is provided in the empirical chapters.

Figure 2: Comparing progress in reducing disparities in maternal vs. child healthcare access, by wealth quintiles

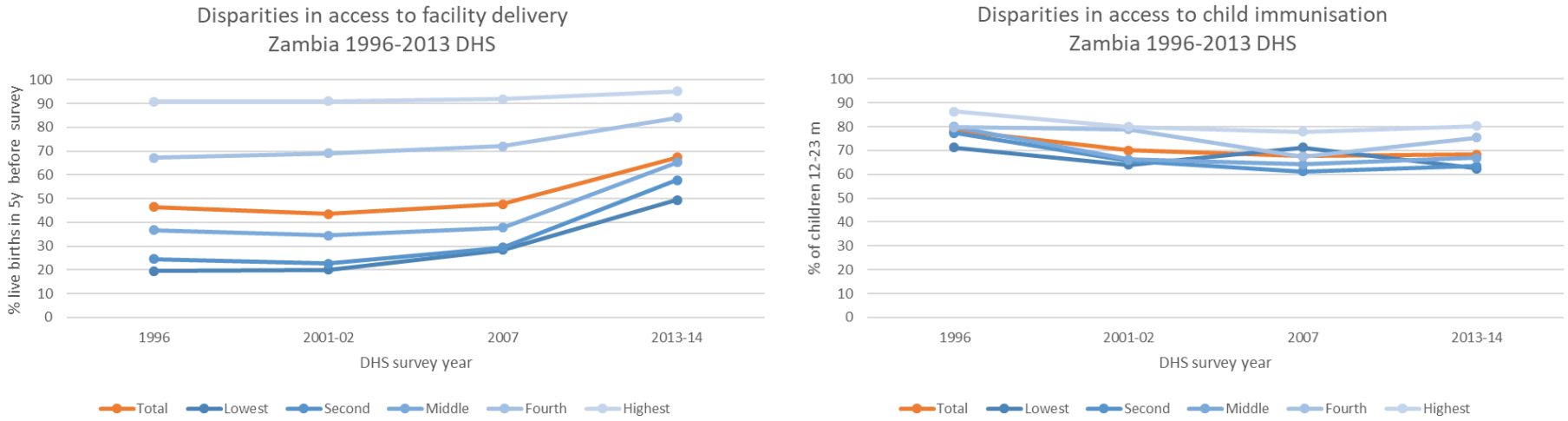
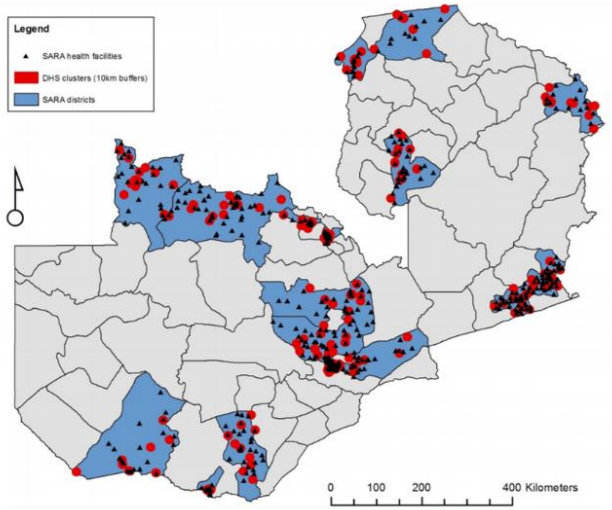


Figure 3: Papers' geographic areas of focus

Papers 1, 2 & 4: SARA districts (in blue)



Paper 3: Mansa district (yellow arrow)

6. Theories applied in the thesis

The thesis draws on a relational framework of healthcare accessibility, which is described in detail in Section 7. Paper 2 engages with Fundamental Causes theory by Link and Phelan (1995) and the Inverse Equity Hypothesis by Victora, Vaughan, Barros et al. (2000). Paper 3 is grounded in a theoretical framework of social exclusion, while Paper 4 strongly engages with intersectionality theory.

6.1. Fundamental Cause Theory and the Inverse Equity Hypothesis

Fundamental Causes Theory (FCT), developed by Link and Phelan, argues that health inequities result from differences in immutable fundamental causes. *"…a fundamental social cause involves resources like knowledge, money, power, prestige, and social connections that strongly influence people's ability to avoid risks and to minimize the consequences of disease once it occurs."* (Link and Phelan, 1996, p. 472). FCT implies that health inequities will persist as long as there are inequities in the fundamental causes, regardless of policies seeking to achieve equity in treatment (e.g.: antibiotics), to reduce risk factors (e.g.: knowledge-raising campaigns about the risks of smoking), or to eliminate diseases (e.g. sewerage infrastructure). This is because new treatments, diseases and risk factors emerge over time, such that even if proximate drivers of inequity were resolved in the past, socio-economic differences in power, financial resources, knowledge, etc. can be relied upon to create new inequities in relation to new health risks and opportunities. FCT's insight is that fundamental causes are "portable", influencing health and disease over the long-term regardless of the specific situation. Resolving health inequities in a durable manner will depend on resolving inequities in the fundamental causes. While FCT is formulated in relation to health *outcomes* and disease, it implies that the distribution of health*care* access in a population is also subject to the fundamental causes. FCT has been criticised for not providing sufficient guidance on whether it is possible and useful to implement policies that interrupt the connection between fundamental causes and health (Krieger, 2001; Valles, 2018), a critique I address in Paper 2.

There is a very close relationship between FCT and the Inverse Equity Hypothesis (Victora et al., 2000), which was formulated in response to inequality trends in child health in Latin America. The Inverse Equity Hypothesis proposes that new healthcare interventions will initially increase health inequities because the most advantaged in a society will have privileged access to them. Later, the less advantaged catch up, and inequalities reduce. Both FCT and the Inverse Equity Hypothesis belong to "political economy" models of social epidemiology, whereby explanations for health inequalities are ascribed to political and economic determinants (Krieger, 2001).

6.2. A framework for social exclusion

Kabeer's (2000) theoretical framework of social exclusion has several advantages for filling existing gaps in the literature on inequalities in maternal health. Firstly, it includes different forms of disadvantage, such as economic or cultural (i.e. representational) disadvantage, into a single metric and recognises that different forms of exclusion can reinforce or counteract each other. This allows for the consideration of all forms of inequality, whether related to poverty or to prescribed gender norms around marital status and reproduction, in a single framework. Secondly, it defines the consequences of representational disadvantage as an injustice, which allows Paper 3 to look beyond "access", "quality of care" and "health outcomes" when describing health inequity. As cited by Kabeer:

> *Disrespectful behaviour does not represent an injustice solely because it constrains the subjects in their freedom for action or does them harm. Rather, such behaviour is injurious because it*

> *impairs these persons in their positive understanding of self - an understanding acquired by inter-subjective means* (Kabeer, 2000).

Thirdly, the framework draws attention to how institutions (such as health facilities or health systems) operate as potential agents of exclusion. Institutions govern the distribution of resources, such as access to high quality and respectful maternal healthcare, according to rules that can have equal or unequal effects, depending on how much the rules privilege existing endowments or group belonging. The institutions and the rules do not themselves cause social exclusion. Rather it is the social interactions and power relations between groups that both result in the creation of unfair institutions and rules, and the way in which these rules are applied.

Based on prior social theory, Kabeer identifies three practices through which groups can use institutions to exclude. Firstly, 'mobilisation of institutional bias' (Lukes, 1974), defined as *'a predominant set of values, beliefs, rituals and institutional procedures ("rules of the game") that operate systematically and consistently to the benefit of certain persons and groups at the expense of others.'* (Bachrach and Baratz, cited in Kabeer, 2000, p. 91). Secondly, 'social closure' (Parkin, 1979) through which *'social collectivities seek to maximise rewards by restricting access to resources and opportunities to a limited circle of eligibles'* (Kabeer, 2000, p. 92). And thirdly, 'unruly practices' (Fraser, 1989; Gore, 1993), which refer *"to the gap between rules and their implementation, which occurs in practice in all institutional domains"*(Kabeer, 2000, p. 92).

6.3. Intersectionality

Intersectionality is a research paradigm originating in the analytical contributions of Black feminist scholars in the US, in reaction to feminist thought that emphasised the experiences of White women, and critical race scholarship that emphasised the experiences of Black men. They showed that Black women's experiences are not the sum of White women's experience of sexism and of Black men's experiences of racism, but constitute a specific type of oppression (Crenshaw, 1989).

In reaction to this erasure of unequal experiences within categories of race and gender, several different approaches have emerged to "doing" intersectionality. In a landmark essay, McCall (2005) classifies these into: (1) The anti-categorical approach, which rejects the usefulness of categories such as gender and class altogether, and sees the categories themselves as creating the inequities they describe. (2) The intra-categorical approach, where scholars focus on a particularly neglected point of intersection, describing the experiences of this social location (e.g. queer women of colour) and contrasting it with a privileged location (e.g. white heterosexual cis-women). (3) The inter-categorical approach, which concentrates on exploring how belonging to a range of different oppressed or privileged categories affects outcomes of interest beyond what we would expect from the additive effect of these categories.

Intersectionality emphasises the mutually constitutive processes of power over the categories themselves, finding explanations for inequities in racism and racializing dynamics rather than race, gendering and patriarchy rather than gender, economic exploitation over differences in income, etc. They are mutually constitutive in that each of these processes builds upon the others and reinforces its logic (Brewer et al., 2002). These processes are specific to a time and place and have a historical origin because they are socially constructed (Yuval-Davis, 2006). These processes create privilege as well as oppression, and both must be studied in order to avoid fetishizing difference from an imagined norm (Choo and Ferree, 2010). Intersectionality tells us that these dynamics are embedded in institutions, at all levels and in all spheres of life, from national policy to the workplace, to the family (Sigle-Rushton, 2014). Individual subjects do, however, have agency within social constraints: they

negotiate their social locations and assign meaning to them, and reinforce or challenge the macro processes through their interpersonal relationships (Choo and Ferree, 2010).

7. Conceptual framework of healthcare access

The concept of accessibility to healthcare is core to this thesis and draws on established theoretical frameworks of accessibility. One can distinguish between frameworks that focus on the behavioural components of healthcare access, versus those that emphasise the degree of fit between health services and health user characteristics (Ricketts and Goldsmith, 2005) (Table 1).

Behavioural frameworks focus on the individual's internal decision-making processes and place relatively less emphasis on external constraints. They also distinguish between the decision to seek care and the ability to access care once sought (Andersen, 1995; Rosenstock, 1966; Thaddeus and Maine, 1994). 'Fit' or 'relational' models, on the other hand, conceptualise access as the interaction between health service characteristics and health user characteristics (Bertrand et al., 1995; Penchansky and Thomas, 1981; UN, 2000).

7.1. Healthcare accessibility in this thesis

This thesis draws more strongly on relational frameworks, for two reasons. Firstly, the decision to seek care is so inextricably linked to the ability to access care that distinguishing between the two creates unhelpful conceptual overlap. Secondly, a relational framework is better suited to the analysis of systemic inequalities by highlighting that the health system serves the needs and abilities of some better than others. While behavioural frameworks consider cognitive and psychosocial barriers in more depth, these important dimensions of accessibility have been integrated in some relational frameworks as well (Bertrand et al., 1995). The final accessibility framework (Table 1) was validated by key informant interviews conducted for this thesis (Chapter 6, Section 1.2).

Table 1: Key dimensions of accessibility

Note: Yellow cells indicate that the framework in that column includes that particular dimension. The text inside the cell is the name given to that accessibility dimension within that framework. Orange cells indicate that the concept is only partly included in a given framework. Definitions are referenced where appropriate. Non-referenced definitions were developed by the author. Table adapted from Choi et al. (2014).

	BEHAVIOURAL MODELS		**RELATIONAL OR 'FIT' MODELS**		
ACCESSIBILITY DIMENSIONS USED IN THE THESIS	Andersen (1995)	Rosenstock (1966)	Penchansky and Thomas (1981)	Bertrand et al. (1995)	UN Right to health (2000)
Availability "The relationship of the volume and type of existing services to the clients' volume and types of needs" (P & T 1981)					
Geographic accessibility "The relationship between the location of supply and the location of clients, taking into account client transportation resources and travel time, distance and cost" (P & T 1981)	Enabling Resources (community)				Accessibility (geographic)
Affordability "The relationship of prices of services to the clients' income, ability to pay, and health insurance" (P & T 1981)	Enabling Resources (personal)			Economic accessibility	Accessibility (economic)
Administrative accessibility "The relationship between the manner in which the supply resources are organised to accept clients and the clients' ability to accommodate to these factors, and the clients' perception of their appropriateness" (P&T 1981)	Enabling Resources (community)		Accommodation		

	BEHAVIOURAL MODELS		RELATIONAL OR 'FIT' MODELS		
ACCESSIBILITY DIMENSIONS USED IN THE THESIS	Andersen (1995)	Rosenstock (1966)	Penchansky and Thomas (1981)	Bertrand et al. (1995)	UN Right to health (2000)
Perceived quality of care Clients' perception of the extent to which they are likely to receive effective care once they access a facility	Health Beliefs (beliefs about health services)	Perceived benefits of taking action	Acceptability (attitudes of users towards providers' professional characteristics)	Quality of care	Quality of care
Cognitive accessibility "Extent to which potential clients are aware if the locations of service (…) points and of the services available at these locations"(Bertrand et al., 1995) Also includes the extent to which health education has been successful in explaining the benefits of quality biomedical care	Health Beliefs (health knowledge)	Perceived susceptibility Perceived seriousness			Accessibility (informational)
Psychosocial accessibility "Extent to which clients are constrained by psychological, attitudinal or social factors in seeking out services" (B et al 1995). E.g.: disrespect or discrimination from health workers and other patients; unacceptable care in the context of beliefs.	Predisposing Characteristics (social structure) Enabling Resources (quality of social relationships)		Acceptability (attitudes of users towards providers' personal characteristics)		Acceptability (culturally appropriate, respecting confidentiality)

7.2. Zambian evidence

Many of these accessibility dimensions or healthcare access barriers have previously been shown to be relevant in the Zambian context, though they have never been quantitatively evaluated as a group of factors. Most studies emphasise geographic, affordability, and psychosocial barriers. Difficulty in reaching the nearest facility, due to distance and lack of transport, is described as a major barrier for many women (Gabrysch et al., 2011; Hjortsberg, 2003; Mutale et al., 2017, 2013; Sialubanje et al., 2014a, 2014b). Affordability remains an issue, despite the removal of user fees in 2006, due to the cost of transport and because women are required to bring various items to the delivery, such as a notebook, baby clothes, industrial disinfectant, a plastic sheet, a cord clamp, etc. (Chibuye et al. 2018; Kaiser et al. 2019; MacKeith et al. 2003; Mulenga et al. 2018; Phiri and Moland 2014; Scott et al. 2018; C. Sialubanje et al. 2015; Sialubanje et al. 2014; Stekelenburg et al. 2004). Psycho-social barriers are also important, including young women's low autonomy (Banda et al., 2016; Sialubanje et al., 2014a), the unacceptability of young or male nurse-midwives and being examined early in the pregnancy, as well as disrespectful care (Mutale et al., 2013; Sialubanje et al., 2014b).

The presence of availability barriers and low perceived quality of care is implied by qualitative studies emphasising that the lack of skilled health workers and drug stock-outs discourages women from seeking a facility delivery (Mutale et al., 2017, 2013; Sialubanje et al., 2014a). Only one administrative barrier has been documented in the literature to date, the requirement to bring the father of the baby when registering the pregnancy in order to access antenatal, perinatal and postnatal care (Sialubanje et al., 2014a). Sialubanje et al (2014a) did not find evidence of cognitive barriers, but on the contrary found that women were aware of the risks inherent in childbirth, and believed that biomedical healthcare could address complications should they arise. However, Sialubanje and many others also report that multi-parous mothers are less likely to view facility delivery as necessary in light of their previous childbirth experience, which is a misconception as complications can arise regardless of parity (Banda et al., 2012, 2016; Mulenga et al., 2018; Scott et al., 2018; Sialubanje et al., 2015, 2014a).

8. A note about wording

In this thesis, the words "inequalities" and "inequities" are used interchangeably. Since the unjust nature of maternal health disparities is established in the first section of the introduction, both terms are used to refer to: *"[health] differences that are unnecessary and avoidable but, in addition, are also considered unfair and unjust*" (Whitehead, 1991, p. 219).

The thesis refers to Zambia as belonging to a group of countries labelled "Low- and Middle-Income Countries" (LMIC), following the World Bank definition, though it is itself a lower-middle income country according to the World Bank classification. This term avoids language associated with modernization[10] theory: "developing" countries. However it has the disadvantage of grouping the world's countries into only two groups (LMIC vs. high-income countries), which does not accurately describe the distribution of countries according to standard of living (Rosling, 2018). In parts of the thesis, I also use the terminology "Global South" and "Global North", when specifically referring to current and/or historical unequal power relations between countries in the "North" and the "South".

[10] Defined in the introduction of Paper 4

9. Organisation of the thesis

The four empirical papers of this thesis are presented in the following four chapters, Chapters 2 to 5, but are referred to in the text as Paper 1 to 4. Paper 1 presents the concept of health service environments and investigates its relevance for predicting access to facility delivery in Zambia. Paper 2 introduces and tests the Concurrent Barrier Hypothesis, based on the access barriers that make up the health service environment. Paper 3 qualitatively explores inequities in women's pregnancy and childbirth experiences. Paper 4 introduces an approach to challenging categorical thinking in health inequalities research, demonstrating it by explaining socio-economic inequalities in access to facility delivery in Zambia.

Following the empirical papers, the thesis proceeds Chapter 6, which reflects on the qualitative and quantitative methods used in the thesis, the ethical issues encountered over the course of the research, and my positionality as a researcher. The concluding chapter summarises the results of the thesis and describes the key contributions and implications of this thesis for research and policy.

Appendices pertaining to a specific paper are included immediately after the relevant empirical paper. Because the papers are written as stand-alone studies for publication in a journal, the appendices may repeat information provided in previous chapters or may partly reproduce other papers' appendices. I have also included "Thesis appendices" at the end of the thesis. These appendices provide information not included elsewhere and are not referred to in the empirical papers.

Chapter 2: The predictive power of health service environments: A novel approach to explaining maternal healthcare access inequalities[11] (Paper 1)

This paper has been published in BMJ Global Health: Sochas, L., 2020. The predictive power of health system environments: a novel approach to explaining inequalities in maternal healthcare access. BMJ Glob. Heal. 4. https://doi.org/doi:10.1136/ bmjgh-2019-002139

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[11] This paper was published under the title "The predictive power of health system environments: A novel approach to explaining maternal healthcare access inequalities". However in my subsequent writing I realised that I was referring to the organisation of local "health services", whereas "health system" implies a single, national system (though the latter structures the former). Therefore I have changed the term "health system environment" to "health service environment" throughout the thesis.

Abstract

The growing use of Geographic Information Systems (GIS) to link population-level data to health facility data is key for the inclusion of health service environments in analyses of health disparities. However, such approaches commonly focus on just a couple aspects of the health service environment and only report on the average and independent effect of each dimension.

Using GIS to link Demographic and Health Survey data on births (2008-2013/14) to Service Availability and Readiness Assessment data on health facilities (2010) in Zambia, this paper rigorously measures the multiple dimensions of an accessible health service environment. Using multilevel Bayesian methods (Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy), it investigates whether multidimensional health service environments defined with reference to both geographic and social location cut across individual and community-level heterogeneity to reliably predict facility delivery.

Random intercepts representing different health service environments have an Intraclass Correlation Coefficient of 25%, which demonstrates high levels of discriminatory accuracy. Health system environments with four or more access barriers are particularly likely to predict lower than average access to facility delivery. Including barriers related to geographic location in the non-random part of the model results in a Proportional Change in Variance of 74% relative to only 27% for barriers related to social discrimination.

Health system environments defined as a combination of geographic and social location can effectively distinguish between population groups with high versus low probabilities of access. Barriers related to geographic location appear more important than social discrimination in the context of Zambian maternal healthcare access. Under a progressive universalism approach, resources should be disproportionately invested in the worst health service environments.

1. Introduction

Skilled, high-quality birth attendance is crucial to preventing maternal and neonatal mortality (Miller et al., 2016). However, inequalities in access to skilled birth attendance and facility delivery in Low and Middle Income Countries (LMICs) remain larger than inequalities in other primary healthcare areas (Boerma et al., 2018). Designing effective interventions to reduce inequalities in maternal healthcare access in LMICs is not straightforward. A review of interventions to reduce maternal and child health inequalities in LMICs found great variation: interventions can increase, decrease or fail to impact health inequalities (Yuan et al., 2014).

Better information on the determinants of maternal healthcare inequalities could help policy-makers in LMICs reduce inequalities more effectively. Many existing quantitative studies describe which types of women are less likely to access a health facility delivery according to individual characteristics such as age, wealth, education, rural-urban residence, or parity, without investigating how health service environments might be shaping these disparities. These are typically data-driven analyses that rely solely on widely available household surveys (e.g.: Multiple Indicator Cluster Surveys (MICS) and Demographic Health Surveys (DHS)), which measure individual characteristics but not contextual variables (Amo-adjei et al., 2018; Asrese and Adamek, 2017; Nghargbu and Olaniyan, 2017). Because such an approach erases health system characteristics as potential variables, it can implicitly "blame the victim" while absolving the state from reforming health services and financing (Desai, 2000; Gabrysch and Campbell, 2009). This is particularly the case when authors fail to interpret

individuals' demographic characteristics as social determinants of health rooted in broader patterns of power and injustice (Marmot et al., 2008).

Merlo and co-authors, in a recent article on geographic health inequalities, state that we should "start searching for better geographical definitions of the context that influence the [health] outcome of interest or to even combine geographical and social information to better define contexts" (Merlo et al., 2019, p. 8). The latter is precisely the context that this study attempts to capture with the concept of "health service environments": the geographically and socially mediated accessibility of a local health system for the health users that surround it. The accessibility of a given health service environment should vary within a population depending on the geographic distribution of health services (facilities, staffing, levels of care) relative to the population, but also depending on how inclusion and exclusion are socially patterned. For example, a given neighbourhood may be geographically close to a hospital providing high quality care, but poor women within that neighbourhood may be discouraged from accessing care by discriminatory practices at their local facility (Paper 3).

Linking individual-level data to health facility lists through Geographic Information Systems (GIS) enables better measurement of health service environments (e.g.: compared with self-reported access barrier variables in the DHS), with wide geographic reach (Gabrysch et al., 2011). While the use of GIS in maternal and newborn health studies is rapidly growing (Ebener et al., 2015; Makanga et al., 2016; Matthews et al., 2019), most studies only focus on one or two aspects of the health service environment, such as distance to care and/or quality of health services. Only by using theory to define all relevant dimensions of a health service environment and by analysing all dimensions jointly can we understand the overall relevance of the health system context in driving disparities in access, and compare the relative importance of different dimensions.

Importantly, the few studies that do consider multiple elements of the health service environment mainly use multivariable regression analysis, which reports on the average and independent effect of each covariate on facility delivery, controlling for every other covariate in the model (Gabrysch et al., 2011). Multivariable regression coefficients do not take into account the distribution of facility delivery around the average for those observations where a given covariate equals one, or the overlap in the distributions for observations where the covariate equals one and for observations where the covariate equals zero (Merlo et al., 2019). For example, while distance might be strongly and negatively associated with facility delivery, it might be that many individuals who live far away from the facility still access facility delivery (false negatives), while many of those who live close to the facility do not access (false positives). The average and independent effect of a given covariate is therefore not necessarily informative for identifying populations most in need of support.

This study aims to provide policy-relevant evidence on the structural determinants of maternal healthcare access disparities in Zambia by conducting a Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA). Based on currently available literature, it is the first time that (1) MAIHDA is applied outside of a high-income country context, and (2) the "context" for health(care) inequalities combines the geographic and social locations of populations and health services, rather than merely neighbourhoods (Merlo et al., 2019) or intersectional social identities (Axelsson Fisk et al., 2018).

Using the MAIHDA approach, this study investigates the extent to which the multi-dimensional health service environment within which a birth takes place is predictive of facility delivery given individual and community-level heterogeneity within those environments. It asks which dimensions of the health service environment more strongly discriminate between those who will or will not

access facility delivery. In doing so, it designates groups facing health service environments that are in particular need of policy-makers' attention if disparities are to be reduced. Each dimension of the health service environment is framed as a barrier to healthcare access in the analysis. Different combinations of these barriers define a range of potential health service environments.

This innovative approach is demonstrated using the case of Zambia. Zambia has lower levels of facility delivery (67.4% in the period 2008-2014) than many countries in the Southern African region (Central Statistical Office (CSO) [Zambia] et al., 2014), though comparatively low levels of maternal mortality (232 deaths per 100,000 live births in 2015) (WHO et al., 2019). Inequalities in access to facility delivery have been decreasing since 2002, yet the absolute difference between facility delivery rates for the 20% richest and 20% poorest was still almost 50 percentage points between 2008 and 2013 (Central Statistical Office (CSO) [Zambia] et al., 2014).

The Zambian Government has made it a priority to reduce these inequalities: equity of access to healthcare services was part of the mission statement and key principles of the past three National Health Strategic Plans (Republic of Zambia Ministry of Health, 2017, 2011, 2009). Many of the health service environment dimensions listed in the Conceptual Framework section have been documented as barriers to access in the Zambian context, in both qualitative and quantitative studies (Gabrysch et al., 2011; Mutale et al., 2013; Sialubanje et al., 2014a, 2014b). However, quantitative studies have not evaluated the health service environment as a whole, nor have they analysed its predictive power relative to individual and community heterogeneity. The approach demonstrated in this paper might prove particularly useful for other LMIC contexts where further progress on healthcare access inequalities is high on the agenda.

2. Methods

2.1. Conceptual framework

The dimensions of the health service environment investigated in this study are drawn from established "relational" theories of healthcare access. Relational approaches conceptualise accessibility as the extent to which the health system is able to meet health users' needs. According to these theories, the seven relevant dimensions of the health service environment are: affordability, cognitive accessibility, psychosocial accessibility, geographic accessibility, availability, perceived quality of care, and administrative accessibility (Bertrand et al., 1995; Penchansky and Thomas, 1981; UN, 2000). Table 1, adapted from Choi et al (2014), provides definitions for these dimensions in the left-most column and demonstrates how they relate to three existing relational theories of healthcare accessibility. Actual quality of care (as opposed to users' perception of quality), is not part of the conceptual framework since this study is purely concerned with accessibility rather than health outcomes.

Table 1: Dimensions of the health service environment

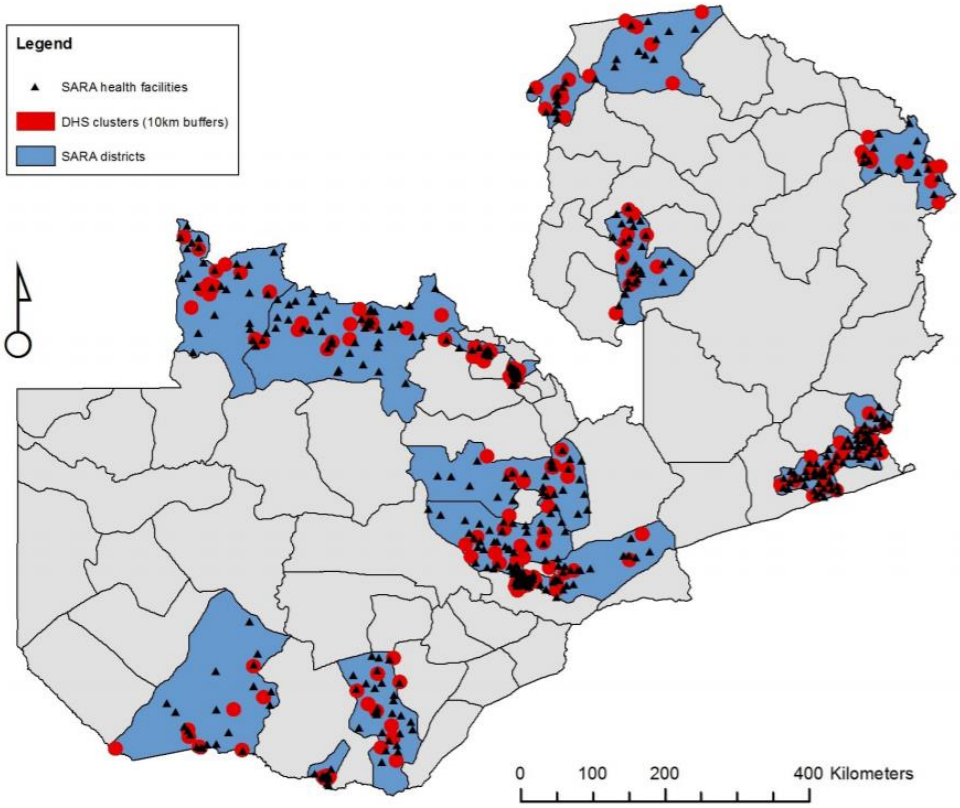
DIMENSIONS	Penchansky and Thomas (1981)	Bertrand et al (1995)	UN Right to health (2000)
Affordability "The relationship of prices of services to the clients' income, ability to pay, and health insurance"(Penchansky and Thomas, 1981)		Economic accessibility	Accessibility (economic)
Cognitive accessibility "Extent to which potential clients are aware if the locations of service (…) points and of the services available at these locations" (Bertrand et al., 1995) Also includes the extent to which health education has been successful in explaining the benefits of quality biomedical care			Accessibility (informational)
Psychosocial accessibility "Extent to which clients are constrained by psychological, attitudinal or social factors in seeking out (…) services" (Bertrand et al., 1995) E.g.: disrespect or discrimination from health workers and other patients; unacceptable care in the context of beliefs.	Acceptability (attitudes of users towards providers' personal characteristics)		Acceptability (culturally appropriate care, respecting confidentiality)
Geographic accessibility "The relationship between the location of supply and the location of clients, taking into account client transportation resources and travel time, distance and cost" (Penchansky and Thomas, 1981)			Accessibility (geographic)
Availability "The relationship of the volume and type of existing services to the clients' volume and types of needs" (Penchansky and Thomas, 1981)			
Perceived quality of care Clients' perception of the extent to which they are likely to receive effective care once they access a facility	Acceptability (user attitudes towards providers' professional characteristics)	Quality of care	Quality of care
Administrative accessibility "The relationship between the manner in which the supply resources are organised to accept clients and the clients' ability to accommodate to these factors, and the clients' perception of their appropriateness" (Penchansky and Thomas, 1981)	Accommodation		

Note: Shaded cells indicate that a theoretical framework includes that particular dimension. The text within the cells is the name given to that dimension by that theoretical framework if it differs from the name in the left-most column. Definitions are referenced where appropriate. Non-referenced definitions were developed by the author.

2.2. Data sources

This study uses a combination of innovative approaches, including: GIS methods to link a population-level dataset to a facility-level dataset (Figure 1) and key informant interviews to select variables for analysis. The two main datasets are: the nationally representative 2013-14 Demographic Health Survey (DHS) and the 2010 Service Availability and Readiness Assessment (SARA), which collected information on all facilities located in 17 of Zambia's districts (out of 72).

Figure 1: Health facilities and Demographic Health Survey (DHS) clusters in districts surveyed by the Service Availability and Readiness Assessment (SARA), Zambia. Produced by the author using ArcGIS 10.



The 2013-14 DHS is a cross-sectional population survey on reproductive, maternal and child healthcare access and outcomes, representative at the national and provincial levels. Individual data is de-identified and geo-referenced according to the central location of the sampling cluster, an enumeration area with an average size of 130 households. The DHS randomly displaces the geo-location of these clusters for confidentiality purposes, by 0-2km for urban clusters, and 0-5km for rural clusters (of which 1% up to 10km) (Central Statistical Office (CSO) [Zambia] et al., 2014). The study sample is at the birth-level. It includes live births where the child's mother resided within one of the 17 SARA districts, that occurred in the five years prior to interview (i.e. those for whom place of birth information was requested during the interview), and where the sampling cluster had a valid geo-reference. Births to mothers who migrated since the birth were excluded as their residence at the time of the birth could not be obtained. Non-singleton births were excluded since they constitute a medical complication that is often identified prior to the birth, resulting in non-comparable decision-making around access to care. Observations with any missing covariates were deleted. The final sample is comprised of 253 clusters and 3,470 live births (further details on the number of observations eliminated at each stage are provided in Appendix 2.1).

The 2010 SARA collected information on health facilities' staffing levels, drugs and equipment, from all facilities in 17 out of Zambia's 72 districts, and geo-referenced the health facility's location. Districts were selected evenly, but not randomly, from across Zambia's 9 provinces, in order to purposefully include malaria sentinel districts and Global Fund evaluation districts, and to include an even mix of predominantly rural and predominantly urban districts. Because of the non-random selection of districts and the fact that the DHS is not designed to be representative at the district level, this study's sample is not statistically representative at the national level. Facilities which were revealed to be located outside of the SARA districts' shapefiles by GIS analysis (Hijmans, 2015), or without a valid geo-reference, were excluded. A total of 596 health facilities are included in the

analysis. The SARA was preferred to the Zambia 2012 health facility list, which covers all health facilities in the country, as the latter lacked sufficient information on quality of care and staffing.

Variable selection was informed by 12 Key Informant Interviews (KII)[12], held in Lusaka in July-August 2017 with respondents from academic, government, international aid, and medical backgrounds, selected purposively for their knowledge of healthcare access in Zambia. Ethical clearance for this study was obtained from the London School of Economics Ethics Committee [ref. 000576] and the University of Zambia Biomedical Research Ethics Committee [ref. 005-06-17]. KIIs focused on the validation of the overall theoretical framework, the selection of the variables from a shortlist provided by the author, additional variable suggestions, and discussion of the strengths and weaknesses of potential variables. The respondents were asked to assess potential variables according to their conceptual closeness to a given dimension and to the availability of high-quality secondary data measuring that variable in the Zambian context.

2.3. Variables[13]

While each of dimension of the health service environment is a complex concept, I selected one variable per dimension to avoid an exponential number of combinations and therefore health service environments, which would have caused the estimate of the probability of facility delivery for each type of health service environment to be imprecise. In order to maximise legitimacy, contextual relevance, and accuracy of measurement, variable selection was informed by the KIIs described above and a Zambia-focused literature review. One dimension, administrative accessibility, could not be measured in this study, due to the lack of a suitable data source. The variables operationalising each dimension of the health service environment are binary and are conceptualised as access barriers, i.e. coded as 1 if the health service environment is not conducive to healthcare access. Descriptive statistics for each variable are provided in Table 2.

Whether a birth occurred in a health facility, or "facility delivery" for short, is the outcome variable for all analyses, and is sourced from DHS data. This variable measures whether the birth occurred at any health facility, including private and public facilities, from health posts to hospitals. Facility delivery is very closely related to being assisted by a skilled provider at birth: 95% of births in a health facility were delivered by a skilled birth attendant (SBA) (i.e. doctor, clinical officer, or nurse/midwife), compared to only 0.7% of births occurring elsewhere (Central Statistical Office (CSO) [Zambia] et al., 2014).

The affordability barrier is defined according to household wealth, and is coded as 1 if the mother's household was in the two poorest wealth quintiles at the time of interview, using DHS data. Since assets that characterise wealth are different in rural versus urban contexts, wealth indices were calculated separately by the author for rural and urban residents, using principle component analysis of housing infrastructure and household assets, and then merged (Filmer and Pritchett, 2001). This variable does not directly measure the relationship between healthcare costs and households' financial resources, neither of which are captured by available data. However, households in the two lowest wealth quintiles are more likely to struggle to afford the cost of a facility delivery. This cost was recently estimated by a study on rural Zambia as $29 for primary-level facilities and $36 for hospitals, despite the absence of formal user fees, relative to an average monthly income of $105 for the poorest rural residents (Kaiser et al., 2019b). Recent qualitative research shows that facility-level expectations

[12] Further information on the KIIs is provided in Chapter 6 of this thesis

[13] Further information on the construction of the geographically defined variables is provided in Thesis Appendix 1

that mothers will bring materials for the delivery constitute a social exclusion mechanism for women without sufficient access to financial resources (Paper 3 of this thesis).

Cognitive and psychosocial barriers are defined according to birth order, using DHS data. Birth orders above one are coded as facing a cognitive barrier. Key informant interviews confirmed conclusions from the Zambian literature that multi-parous mothers are less likely to view facility delivery as necessary because of their previous childbirth experience, even though complications can arise regardless of parity (Mulenga et al., 2018; Sriram et al., 2018). Birth orders of six and above are coded as facing a psycho-social barrier in addition to the cognitive barrier. Key informants reported that women with six or more births are more likely to receive disrespectful care from nurses or midwives, which was confirmed in interviews conducted with mothers in Mansa district in 2018 (Paper 3). These variables only proxy for one of the many reasons why women might face cognitive or psycho-social barriers. The extent to which high birth orders result in discrimination may vary across health facilities and health workers, but such micro-data is not available.

The geographic barrier is defined as whether the mother's DHS sampling cluster at the time of interview was further than 10km from any health facility in the SARA census, measured as a straight-line distance. The last three National Health Strategic Plans (going back to 2006) all make explicit reference to the importance of increasing the percentage of the population living within 5km of a health facility. However, because of the random displacement of DHS sampling clusters, I follow best practice and use a distance of 10km for all geographically-defined barriers in order to minimise the possibility of misclassification (Burgert and Prosnitz, 2014; Wang et al., 2015). I use straight-line distance rather than networked distance due to the noise introduced by other factors such as cluster displacement and the lack of data on means of transport to reach the health facility. I control for the cluster's slope to partially account for the terrain and include year-month fixed effects to account for seasonality of travel time (DHS Program, 2017; Makanga et al., 2016). By construction, any health service environment that lacks geographic accessibility also lacks the availability and perceived quality of care dimensions. This "nesting" of barriers represents the reality of how the geographic, availability and quality barriers operate: one cannot have access to a skilled birth attendant or Comprehensive Emergency Obstetric Care without geographic access to a health facility (in the context of Zambia).

The availability barrier is defined as whether the mother's DHS sampling cluster was further than 10km from any health facility with a midwife, with staffing measured using SARA data. Key informants said that having a sufficient number of skilled staff was important to meet the population's need for skilled childbirth care, which has also been emphasised in the global literature (Downe et al., 2014). Because the SARA did not record the number of staff working in maternity care specifically, and higher-level facilities include many doctors and nurses that do not provide maternity care, I operationalised this variable to focus on midwives specifically. However, in facilities without a midwife, nurses often conduct deliveries. These facilities are still coded as having low availability, since it is assumed that a nurse is more likely to have competing demands on her time beyond delivery care, and availability pertains to the balance between the volume of need and services provided. By construction, any health service environment that lacks availability also lacks the perceived quality of care dimension.

The perceived quality of care barrier is defined as whether the mother's DHS sampling cluster at the time of interview was further than 10km from any health facility with the capacity to provide Comprehensive Emergency Obstetric and Neonatal Care (CEMONC). A CEMONC facility is able to respond to all obstetric complications, including those requiring caesarean section and blood transfusion, and is thus able to save lives when complications arise in childbirth (Freedman et al., 2007). CEMONCs were identified in the SARA data according to whether the facility's manager reported that the facility provided all eight CEMONC signal functions. Reporting was based on the

question: "Which of the following obstetric care services does this facility provide?", combined with a list of signal functions, e.g.: "Parenteral administration of antibiotics", and Yes/No answers for each type of service[14]. Among the facilities included in this study, all facilities coded as providing CEMONC are hospitals, although only 76% of hospitals provided CEMONC. While this variable is likely to overestimate facilities' practical ability to carry out signal functions, and while quality of care goes far beyond signal functions, a CEMONC facility is more likely to be *perceived* by lay persons to provide quality care (Kruk et al., 2009; Siam et al., 2019).

Table 2: Descriptive statistics, Zambia DHS (2013-14) & SARA (2010)

	Study sample Unweighted	**Original dataset**
	% of births	**% of births (DHS) weighted**
Facility delivery	73.9%	67.4%
Affordability barrier *Two poorest wealth quintiles*	47.7%	47.8%
Cognitive barrier *Birth order 1 +*	81.5%	74.7%
Psycho-social barrier *Birth order 6 +*	25.3%	16.3%
	% of births	**% of facilities (SARA) Unweighted**
Geographic barrier *No health facility within 5km*	33.9%	
No health facility within 10km	21.3%	
Availability barrier *No midwife*		55.9%
No midwife within 5km	48.9%	
No midwife within 10km	38.6%	
Quality of care barrier *Not CEMONC*		95.1%
No CEMONC within 5km	72.4%	
No CEMONC within 10km	57.9%	

2.4. Analytical strategy

This study applies an innovative method from social epidemiology: Multi-level Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA) (Evans et al., 2017; Merlo, 2017). This approach has two key advantages. Firstly, it does not only take into account the mean average effect of different dimensions of the health service environment on the outcome, but also the distribution of the outcome within and between groups facing different types of health service environments. This allows the study to estimate the predictive power of the health service environment relative to individual and community heterogeneity (Austin and Merlo, 2017; Merlo, 2017; Wemrell et al., 2017a). Secondly, the MAIHDA approach allows for a more precise estimation of the predicted probability of facility delivery for births in each health service environment, since probabilities for rare combinations are estimated by borrowing information from the mean (Evans et al., 2017). Since this method has been extensively described in other authors' publications, further technical details are provided in Appendix 2.2.

[14] An extract from the SARA questionnaire is provided in Thesis Appendix 1, Figure 1.

In this study, MAIHDA is implemented using a binomial logistic random intercepts model. Births are nested within one of 24 mutually exclusive health service environments, defined according to all feasible combinations of the relevant dimensions or barriers (Table 4). The number of combinations allows for the fact that some barriers cannot be experienced without others. A random intercept is specified for each of the 24 health service environments. In the baseline model, the barrier variables are only represented using random intercepts and are not included as explanatory variables: the non-random part of the model remains empty, apart from control variables where relevant. The Intraclass Correlation Coefficient (ICC) calculates the percentage of the total variance attributable to the health service environment, relative to individual-level variance (and community-level variance, where relevant). The higher the ICC, the more accurately the health service environment as a whole can predict who will and who will not access a facility delivery.

I then explore which dimensions of the health service environment have stronger discriminatory accuracy by comparing the ICC of the environments' random intercepts in an otherwise empty model (described above) versus a range of models that also include the barrier variables in the non-random part of the model (Axelsson Fisk et al., 2018). Once the variable for a given barrier is included in the non-random part of the model, the variance of the environments' random intercepts no longer captures the additive effect of that barrier variable and is reduced. The larger the proportional difference between the random intercepts' variance in the two models, the more discriminatory accuracy that dimension or barrier has. I estimate all models using Bayesian Markov Chain Monte Carlo (MCMC) methods, as recommended in the MAIHDA literature (see Appendix 2.3 for details) (Evans et al., 2017). Bayesian statistics do not produce frequentist measures of statistical significance, such as t-statistics and P-values. Uncertainty is communicated using 95% Bayesian credible intervals: there is a 95% probability that the parameter of interest is contained with the credible interval[15].

I include an additional, cross-classified random intercept at the DHS sampling cluster level in sensitivity analyses. This allows for a better estimate of the uncertainty of point estimates, by accounting for the fact that births within mothers and mothers within clusters are likely to be more similar to each other than to births from different mothers or in different clusters. This random effect also represents community-level heterogeneity, which is of substantive interest. In order for the model to accurately partition the variance between the two cross-classified random effects, there must be a sufficient degree of interpenetration between membership of the community (cluster) and membership of the health service environment. While the geographic, availability, and quality of care dimensions do not vary by cluster, the other three dimensions do, making a total of six potential health service environments within each cluster. According to Vassalo et al (2017), this is a sufficient level of interpenetration between levels. Where a cluster-level random intercept is included, the calculation of the ICC includes the variance of this new random intercept in the denominator. I also include individual-level control variables shown to be associated with facility delivery (Gabrysch and Campbell, 2009): marital status (a dummy for being married), educational achievement (a dummy for having reached secondary school or above), and age of the mother at birth (continuous variable in years). Other controls are related to the distance barrier: how steep the terrain of the sampling cluster is, and seasonality of time of birth (fixed effects for month-year of birth). I do not include rural-urban residence as a control variable because it is collinear with the quality of care barrier.

2.5. Limitations

This analysis presents a number of limitations. Some of the variables chosen to measure each dimension measure only one part of that concept, leaving other parts unaddressed. This is particularly

[15] Conditional on the data and model

true for the cognitive and psychosocial dimensions. This limitation is the corollary of building a parsimonious model with a sufficient number of combinations to allow the variance of the environments' random effects to be reliably estimated, while allowing for few enough environments to predict probabilities for each environment accurately. This limitation was partly addressed by drawing on a literature review and primary qualitative research to operationalize variables for the Zambian context, in order to maximise the legitimacy and contextual relevance of the variables chosen.

The variance of the random effects may be capturing the influence of omitted variables correlated both with the environment and the outcome variable. Control variables and cluster-level random effects were included in the model in order to partially address this bias. The theoretical grounding of the model also addresses this limitation, by guiding the inclusion of all major dimensions of accessibility in a single model. Only one major dimension could not be included due to lack of data: administrative accessibility.

DHS clusters are randomly displaced to maintain participant confidentiality. Some births will have been mistakenly classified as suffering from the geographic, availability or quality barriers when they did not, and vice-versa. The direction of this bias cannot be predicted. In order to partially address this issue, I define distance-related variables at the 10km level (Burgert and Prosnitz, 2014; Wang et al., 2015).

3. Results

In this section, I investigate whether the health service environment is predictive of facility delivery. Conditional on this result, I explore which health service environments predict particularly low access. Finally, I examine whether there are aspects of the health service environment that are more predictive than others, and which dimensions are particularly important.

3.1. Discriminatory accuracy of the health service environment

In the most robust model, which operationalises barriers using 10km variables, controls for confounders, and accounts for community heterogeneity, 25% of the total variance in facility delivery is explained by the variance between health service environments (model 3, Table 3). The variance in facility delivery between births facing different health service environments is estimated at 1.56 (for which the 95% Bayesian credible intervals do not include zero). This is larger than the variance in facility delivery between "communities" (operationalised according to DHS sampling clusters), estimated at 1.30. The remainder of the variance is that between individuals, which is fixed at 3.29 for binomial logistic models.

An ICC of 25% represents a high level of discriminatory accuracy, or predictive power: Axelsson-Fisk et al. (2018), drawing on cut-offs used in psychometric test reliability assessments, suggest that an ICC of 20-30% is "very good", while Merlo et al. (2019) state that 20-30 points to "fairly large" differences between groups.

Table 3: Intraclass correlations for health service environments, Zambia 2013-14

	No controls No cluster RE	**No controls With cluster RE**	**With controls With cluster RE**
10km variables	**(1)**	**(2)**	**(3)**
ICC HS environments	27%	27%	25%
ICC components:			
Variance HS environments	1.20 (0.50-2.10)	1.59 (0.62-2.82)	1.56 (0.56-2.83)
Variance communities	NA	1.10 (0.72-1.51)	1.30 (0.85-1.78)
Variance individuals	3.29	3.29	3.29
5km variables	**(4)**	**(5)**	**(6)**
ICC HS environments	26%	25%	22%
ICC components:			
Variance HS environments	1.13 (0.48-1.96)	1.50 (0.58-2.65)	1.36 (0.48-2.46)
Variance communities	NA	1.22 (0.83-1.66)	1.43 (0.95-1.93)
Variance individuals	3.29	3.29	3.29

Interpretation: The Intraclass Correlation Coefficient (ICC) indicates the proportion of the variance in facility delivery that can be explained by the variance between health system (HS) environments, controlling for confounders and accounting for clustering within Demographic Health Survey (DHS) sample clusters. Individual-level variance is set at 3.29 for binomial logistic models. (95% Bayesian Credible Intervals in parentheses)
Controls: mothers' age at birth, married, secondary school or higher, cluster slope, month-year fixed effects.
Cluster random effects (RE): model also includes a cross-classified random intercept for DHS sampling clusters in addition to the environments' random intercepts.
5km variables: geographic, availability and quality variables defined at the 5km level – others defined as normal
10km variables: geographic, availability and quality variables defined at the 10km level – others defined as normal

3.2. Which health service environments predict low facility delivery?

Results show that 91% of the sample face health service environments with at least one barrier, while 6% of the sample live in a health service environment where all six barriers are present (Table 4, unweighted). There are wide disparities in the probability of accessing a facility delivery depending on the health service environment. Unsurprisingly, women living in a health service environment with all six barriers have the lowest chance of giving birth in a health facility (41% probability), while women facing an environment with no barriers have a 94% probability of doing so. All births facing four barriers or more (combinations #1-#7; 33% of the sample) have a predicted probability of facility delivery that is below average (73.9% in the study sample, unweighted) (Table 4).

With some exceptions, health service environments with fewer barriers have a higher predicted probability of facility delivery than environments with a greater number of barriers. Exceptions are likely explained by the uncertainty of the point estimates, described by the credible intervals in the right-most column, as well as the particularly strong contributions of some barriers (e.g. geographic accessibility). In general, there are larger disparities between health service environments where the number of barriers is different, compared to disparities between health service environments with the same number of barriers but where the specific barriers faced are different.

Table 4: Predicted probability of facility delivery for women facing different health service environments, Zambia 2013-14

#	Births N	Births * %	Barriers N	affor	cogn	psyc	geog	avail	qual	Pred prob	CI
1	214	6%	6	yes	yes	yes	yes	yes	yes	0.41	0.34-0.48
2	271	8%	5	yes	yes	no	yes	yes	yes	0.42	0.35-0.48
3	90	3%	4	no	yes	no	yes	yes	yes	0.49	0.39-0.60
4	67	2%	5	no	yes	yes	yes	yes	yes	0.52	0.40-0.64
5	160	5%	5	yes	yes	yes	no	yes	yes	0.52	0.44-0.60
6	230	7%	4	yes	yes	no	no	yes	yes	0.60	0.53-0.66
7	75	2%	4	yes	no	no	yes	yes	yes	0.60	0.49-0.71
8	47	1%	4	no	yes	yes	no	yes	yes	0.64	0.49-0.78
9	105	3%	4	yes	yes	yes	no	no	yes	0.66	0.56-0.75
10	59	2%	3	yes	yes	yes	no	no	no	0.66	0.54-0.78
11	22	1%	3	no	no	no	yes	yes	yes	0.67	0.48-0.84
12	71	2%	3	no	yes	yes	no	no	yes	0.72	0.61-0.83
13	225	6%	3	yes	yes	no	no	no	yes	0.72	0.66-0.79
14	64	2%	3	yes	no	no	no	yes	yes	0.78	0.68-0.88
15	62	2%	2	yes	no	no	no	no	yes	0.82	0.72-0.91
16	154	4%	2	yes	yes	no	no	no	no	0.82	0.76-0.88
17	153	4%	2	no	yes	no	no	no	yes	0.83	0.77-0.89
18	29	1%	2	no	no	no	no	yes	yes	0.84	0.72-0.95
19	71	2%	3	no	yes	no	no	yes	yes	0.84	0.75-0.93
20	155	4%	2	no	yes	yes	no	no	no	0.86	0.80-0.91
21	37	1%	1	yes	no	no	no	no	no	0.90	0.80-0.98
22	758	22%	1	no	yes	no	no	no	no	0.93	0.91-0.95
23	299	9%	0	no	no	no	no	no	no	0.94	0.92-0.97
24	55	2%	1	no	no	no	no	no	yes	0.96	0.91-1.00

CI: 95% Bayesian Credible Intervals. Affor – affordability barrier; Cogn – cognitive barrier; Psych – psychosocial barrier; Geog – geographic barrier; Avail – availability barrier; Qual – quality barrier. % of births is unweighted*

3.3. Do some aspects of the health service environment matter more?

The analysis presented above allows policy-makers to accurately identify population groups that are particularly at risk of not giving birth in a health facility. As a next step, investigating whether specific dimensions of the health service environment are particularly predictive of facility delivery could help policy-makers prioritise these dimensions for improvement.

The inclusion of the affordability, cognitive and psychosocial dimensions in the non-random part of the model (in separate models) reduces the variance of the environments' random effects by 15% or less (models 2-4, Table 5), compared to 47% or more for the geographic, availability, and quality barriers (models 5-7, Table 5). The greater predictive power of these last three dimensions is confirmed by comparing the change in the variance when the first three barriers are all included in the non-random part of the model (a change of -27%) (model 8, Table 5), relative to when the last three barriers are all included (a change of -74%) (model 9, Table 5).

Table 5: Comparing the discriminatory accuracy of different dimensions within the health service environment using the proportional change in variance, Zambia 2013-14 (Binomial logistic random intercepts model)

Facility delivery	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
	Reference model	**Affordability**	**Cognitive**	**Psychosocial**	**Geographic**	**Availability**	**Quality**	**Afford+ Cogn + Psych**	**Geog + Avail + Qual**
ICC	25%	23%	22%	25%	14%	13%	15%	20%	8%
PCV	Reference model	-12%	-15%	-4%	-52%	-54%	-47%	-27%	-74%
Variance: HS environments	1.6	1.4	1.3	1.5	0.7	0.7	0.8	1.1	0.4
	(0.6;2.8)	(0.5;2.6)	(0.5;2.5)	(0.5;2.8)	(0.2;1.4)	(0.2;1.4)	(0.2;1.6)	(0.3;2.2)	(0.1;0.9)
Variance: DHS clusters	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3
	(0.8;1.8)	(0.9;1.8)	(0.8;1.8)	(0.9;1.8)	(0.9;1.8)	(0.9;1.8)	(0.9;1.9)	(0.8;1.8)	(0.9;1.8)
Additive effects ***(logit coeffs)***									
affordability		-0.8						-0.9	
		(-1.9;0.2)						(-1.8;0.1)	
cognitive			-1.2					-1.1	
			(-2.3;-0.1)					(-2.2;0.1)	
psychosocial				-0.9				-0.3	
				(-2;0.3)				(-1.5;0.8)	
geographic					-2.0				-1.2
					(-3;-1)				(-2.2;-0.2)
availability						-1.7			-0.6
						(-2.6;-0.9)			(-2.2;-0.2)
quality							-1.8		-1.0
							(-2.8;-0.8)		(-1.9;-0.1)
Constant	-8.7	9.2	0.5	-1.6	1.4	4.2	11.4	-0.9	4.2
	(-17.3;1.5)	(-6.4;21.8)	(-8.6;10.8)	(-9.9;9.4)	(-6.3;9.8)	(-8.2;20.1)	(-1.4;23.4)	(-13.8;7.8)	(-5.9;14.1)

Interpretation: Including a barrier variable in the non-random part of the model in addition to the random part ensures that the HS environments random effects' (RE) variance no longer accounts for the additive effect of that variable. This analysis shows the extent to which the Intraclass Correlation Coefficient (ICC) decreases with the inclusion of each dimension. A greater decrease in the ICC (and a correspondingly large PCV) indicates that a specific barrier contributes more strongly to the health service environments' collective discriminatory accuracy.
Notes: 95% Bayesian Credible Intervals in parentheses. Controls included in this analysis: mothers' age at birth, married, secondary school or higher, cluster slope, month-year fixed effects. The model also includes a cross-classified random intercept for DHS sampling clusters in addition to the environments' random intercept. Individual-level variance is set at 3.29.

4. Discussion

This study uses geo-referenced population-level and facility-level datasets to rigorously measure the multiple dimensions of an accessible health service environment. It then uses random intercepts as part of an innovative approach, MAIHDA, to investigate whether multidimensional health service environments can reliably predict facility delivery.

This study shows that health service environments meaningfully predict which births are most or least likely to take place in a health facility in Zambia, even when controlling for common individual-level determinants and taking into account residual differences between individuals and communities facing similar health service environments. Given that the health service environment reliably organises the population into groups that are differentially likely to access facility delivery, policy-makers may want to know which types of health service environments are particularly discouraging. The predicted probabilities of facility delivery for each health service environment show clearly that the environments predicting lower levels of facility delivery are generally those characterised by a greater number of barriers. Environments with four or more barriers are particularly likely to be disadvantaged. Under a progressive universalism approach, these types of health service environments should be improved as a priority (Gwatkin and Ergo, 2011).

The geographic, availability, and quality of care dimensions are particularly predictive of access to facility delivery in Zambia. This implies that aspects of the health service environment linked to the geographic location of infrastructure, staffing and other resources required for high quality care predicts access more strongly than exclusion linked to patients' financial resources, their parity, or unaddressed misconceptions. These dimensions also "hang together" from a common-sense (and evidence-based) perspective, since it would be ill-advised to build new health facilities without staff, drugs, equipment or infrastructure (Campbell et al., 2016). From a theoretical perspective, the geographical relationship between the health system and the population appears to more strongly structure who accesses healthcare than social location, which indicates implicit or explicit social exclusion within the health system. The results could also be affected by measurement limitations. Data constraints meant that the affordability, cognitive, and psychosocial dimensions were crudely measured using individual characteristics that we know tend to be discriminated against by the existing health system, rather than data on geographic proximity to discriminating providers or facilities.

This study's results are consistent with Gabrysch et al (2011), who analyse the average and independent effect of distance and quality of care barriers (which is defined to include staffing) on facility delivery in Zambia in 2002-2007, controlling for household wealth and birth order, among other confounders. The authors conclude that under a causal interpretation, ensuring that all women live within 5km of a basic emergency obstetric care facility with appropriate staffing would reduce the proportion of home deliveries by a greater extent than if all households were in the richest wealth quintile.

The health service environments defined in this paper reflect a relational and multi-dimensional view of the context of health inequalities, linking health system resources, the geographic distribution of these resources relative to the population, and the overt or implicit social exclusion of women inhabiting certain social locations. This frame encourages policy-makers to ask new questions in their efforts to address disparities: *Where* to build new facilities or send additional midwives, drugs and equipment? *Which* groups are still unable to afford a facility delivery even after the abolition of user fees? *Which* groups' misconceptions remain un-addressed by health education? *Which* groups experience discrimination within the health system? By linking geographic and social locations, health

system and patient characteristics, this study also demonstrates the contribution that social epidemiology can bring to health policy. The framework adopted in this paper is strongly influenced by eco-social theory, which links multiple levels of analysis to enhance our understanding of health inequities (Krieger, 2001), while the MAIHDA methodology has been developed within the field of (intersectional) social epidemiology (Merlo, 2017).

Gathering additional data on the cognitive and psychosocial dimensions would improve the reliability of future analyses. In the Zambian context, this could involve gathering data on how maternal health information is understood and interpreted by women and their families and on stigmatising staff attitudes. Further research with important implications for equity could build on this study to explore the extent to which inequalities defined by a range of demographic characteristics (e.g. high versus low education; rural vs urban residence) are explained by the different dimensions of the health service environment, using decomposition methods (Paper 4). While this study focuses on healthcare access, the approach used in this paper could be extended to study inequalities in health(care) outcomes or wellbeing. In contrast with healthcare access, social location might prove more important in driving these other types of inequalities, because of the social nature of healthcare interactions (Ramírez, 2016).

5. Conclusion

Health system environments, defined according to the geographic and social locations of health system resources and the populations they serve, can meaningfully predict which births will take place in health facilities and which ones will not. This approach generates important information for policy-makers or activists seeking to reduce disparities in maternal healthcare access. Findings identified the worst health service environments, where resources could be disproportionately invested under a progressive universalism approach. Specific dimensions of the health service environment, i.e.: geographic accessibility, availability, and perceived quality of care, were identified as having particularly strong discriminatory accuracy and should be considered a priority for policies aiming to reduce maternal healthcare inequalities in Zambia.

Appendix 2.1: Sample selection

In the DHS dataset, births to mothers who migrated since the birth were excluded, as their residence at the time of the birth could not be obtained (21,034 excluded out of an original sample of 49,207). Non-singleton births were excluded since they constitute a medical complication that is often identified prior to the birth, such that the determinants of access to care in childbirth are fundamentally different to non-singleton births (496 excluded out of 28,173). Births that occurred prior to 2008 were excluded, as the location of the birth was not recorded in the survey (16,392 excluded out of 27,677). Births that did not have a valid geo-reference were excluded (two sampling clusters and 45 births out of 11,285). Births that were not located in one of the 17 SARA districts were excluded (466 sampling clusters and 7,671 births out of 11,240). Finally, observations with missing values on covariates were excluded (99 out of 3569), leaving a final sample of 3,470 observations.

In the SARA dataset, originally composed of 658 facilities, 17 facilities were dropped due to having no or incorrect geo-references and 45 were excluded due to being identified as located outside of the SARA districts' shapefiles through GIS analysis. The final sample was made up of 596 facilities.

Appendix 2.2: Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA)

MAIHDA is implemented using a logistic random intercepts model (Equation 1):

Equation 1: Baseline logistic random intercept model

$$\text{logit}\{\Pr(y_{ijz} = 1|\theta_{izj}, \mu_{1j}, \mu_{2j})\} = \propto + \theta_{izj} + \mu_{1j} + \mu_{2z}$$

Where:

$$\mu_{1j} \sim N(0, \varphi_1)$$

$$\mu_{2z} \sim N(0, \varphi_2)$$

Where: y_{ijz} is facility delivery for the ith birth nested in both the jth community (i.e.: DHS sampling clusters) and the zth health service environment. α is the overall mean of facility delivery. θ is a vector of control variables.

The two sets of random intercepts μ_{1j} and μ_{2j} are assumed to be normally distributed with mean zero and uncorrelated with each other. The community random intercepts μ_{1j} have variance φ_1, are independently and identically distributed across communities, and are independent from control variables θ_{ijz}. The health service environment random intercepts μ_{2z} have variance φ_2 , are independently and identically distributed across health service environments, and are independent from control variables θ_{ijz} (Rabe-Hesketh and Skrondal, 2008).

Using such a model, the predicted probability of a facility delivery can be estimated for each health service environment. These probabilities are more reliably estimated in a multi-level model than a saturated fixed-effects model, since probabilities for rare combinations are estimated by borrowing information from the mean (Evans et al., 2017).

The health service environments' ICC is calculated as the share of the variance attributable to the health service environment random intercepts' variance , φ_2 , relative to the total variance, made up

of the health service environment random intercepts' variance φ_2, the community random intercepts' variance φ_1, and the individual-level variance, which is set at 3.29 in binomial logistic models (Equation 2). The ICC measures the level of discriminatory accuracy, similar to the Area Under the Receiver operating characteristic curve (AUC) (Merlo, 2017). The higher the ICC, the better the barrier combinations are at distinguishing between who will and will not access a facility delivery.

Equation 2: Intraclass Correlation Coefficient $$\text{ICC} = \frac{\varphi_2}{\varphi_1+\varphi_2+3.29}$$

In subsequent models, I explore which dimensions have the most discriminatory accuracy by comparing the ICC of the health service environments' random intercepts in Equation 1 (model A) versus the ICC of the same random intercepts in a model that also includes barrier variable dummies as main effects (model B). This is calculated using the Proportional Change in Variance (Equation 3) (Axelsson Fisk et al., 2018).

Equation 3: Proportional Change in Variance $$\text{PCV} = \frac{\varphi_{2,B}-\varphi_{2,A}}{\varphi_{2,A}}$$

Appendix 2.3: Markov Chain Monte Carlo estimation

Estimates were generated using a Gibbs sampler, Rjags, from within RStudio v1.0.143. Non-informative priors, 5,000 iteration burn-in and 100,000 saved posterior samples were used. No initialisation values were used, but chains with different random starting points gave similar results, and traceplots indicated good levels of convergence and mixing. The Raftery-Lewis diagnostic indicated an appropriate number of burn-in and saved samples in order to obtain the parameters of interest with a 0.005 margin of error at the 0.025 quartile with 95% accuracy.

Point estimates are the average of the posterior samples for the parameter of interest, while uncertainty is communicated through the credible intervals (CI), the smallest interval covering 95% of posterior samples for the parameter of interest. Predicted probabilities are estimated by calculating the logged odds for each health service environment in each posterior sample using the parameters estimated in the Bayesian model described above, converting logged odds to probabilities, and averaging across posterior samples for each health service environment in order to obtain the point estimate.

Chapter 3: Are interactions between healthcare access barriers stalling progress on equity of access? Introducing the Concurrent Barrier Hypothesis (Paper 2)

This paper is under review in World Development: Sochas, L. 2020. Are interactions between healthcare access barriers stalling progress on equity of access? Introducing the Concurrent Barrier Hypothesis.

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Chapter 3: Are interactions between healthcare access barriers stalling progress on equity of access? Introducing the Concurrent Barrier Hypothesis (Paper 2)

Abstract

Removing a specific barrier to healthcare access has not always successfully decreased inequalities in healthcare access at the population level. One explanation is that disadvantaged groups are more likely to face more than one healthcare access barrier concurrently. If removing a barrier increases access to a greater extent for those who face fewer or no other barriers, then removing a single barrier could increase inequalities. This paper proposes a new hypothesis - the "Concurrent Barrier Hypothesis" - and examines this hypothesis empirically through the case of maternal healthcare access in Zambia. The empirical analysis draws on geo-referenced birth-level data and health facility data. The heterogeneous association between facing healthcare access barriers and accessing a health facility birth is explored through interactions between each barrier and the number of other barriers faced. This study finds that disadvantaged groups, defined by wealth, education, and rural-urban residence, are more likely to face multiple barriers. Out of six barriers, the psychosocial, geographic, and quality of care barriers have a stronger effect on facility delivery the fewer other barriers are faced, a pattern consistent with the Concurrent Barrier Hypothesis. This paper theorises the potential for heterogeneous policy effects due to interactions between barriers in a wide range of policy settings, and recommends that, where positive interactions are present, barriers either be jointly removed or removed as a priority for the most disadvantaged groups in society. The Concurrent Barrier Hypothesis explains how, even when the state actively seeks to intervene and address inequitable situations, inequalities can persist, and what can be done about it.

1. Introduction

Global health practice, research and funding have increasingly aimed to reduce inequalities in health outcomes and healthcare access, instead of focusing only on average improvements. Macro trends suggest that government action is required in order to improve average levels of access in ways that reduce or do not aggravate healthcare access inequalities (Gwatkin and Ergo, 2011; Rodney and Hill, 2014). However, removing key barriers to healthcare access, such as unaffordability, has not always been a successful strategy to decrease inequalities. This paper aims to formalise a hypothesis to explain this pattern, and to empirically examine its relevance in the context of maternal healthcare access in Zambia. I call this hypothesis: "the Concurrent Barrier Hypothesis" (CBH). The hypothesis is as follows: if the most disadvantaged are more likely to face more than one healthcare access barrier concurrently, and if removing a healthcare access barrier increases access to a greater extent for the person who faces fewer or no other barriers, then removing a single access barrier could increase inequalities (conditional on additional assumptions).

Increasing average levels of health outcomes and/or healthcare access often goes hand in hand with increasing inequalities, as described by the Inverse Equity Hypothesis (Victora et al., 2000). At the point when a new healthcare intervention is introduced, average levels of access and inequalities are low; once new health programmes are made available, the rich initially benefit more, which is reflected in medium levels of average access and high inequalities; later on, the poor catch up and we observe high average access and low inequalities (Channon et al., 2012; Victora et al., 2018, 2000). In

summary, there is an inverse-U relationship between average health outcomes or healthcare access and health(care) inequalities. The Fundamental Causes Theory argues that far from being a "one-off" cycle, this pattern repeats endlessly for different health conditions, each time an innovative and scarce medical treatment or public health improvement becomes available (Link and Phelan, 1996). Fundamental Causes Theory predicts that those with higher socio-economic status will always be able to use their power, financial resources, social capital, and knowledge to gain early and privileged access to initially scarce health-promoting technologies.

Government intervention is therefore required to reduce health(care) inequalities and reach universal health coverage in a progressive way. However, such interventions have not always been successful. For example, a widely evaluated approach for reducing healthcare access inequalities in Low and Middle-Income Countries (LMICs) is to remove financial barriers to healthcare access. This can be achieved by abolishing health user fees (Dzakpasu et al., 2014) or by providing social health insurance (Wang et al., 2016), vouchers (Bellows et al., 2013), or cash transfers (Hunter et al., 2017). The literature includes studies in each of the following categories: these intervention were most beneficial for more privileged populations (Dossou et al., 2017; Handa et al., 2016; Johnson et al., 2016; McKinnon et al., 2015a; van der Wielen et al., 2018); for more disadvantaged populations (Dzakpasu et al., 2012; Keya et al., 2018; Nabyonga-Orem et al., 2011; Ravit et al., 2018); had mixed effects depending on the health service or the definition of "disadvantage" (Leone et al., 2016; Penfold et al., 2007; Yiengprugsawan et al., 2011); or did not have heterogeneous effects (Atchessi et al., 2016; De Allegri et al., 2012; Lépine et al., 2017).

A possible explanation for such mixed results that has never been formalised or evaluated is that in some circumstances, removing a healthcare access barrier could be most beneficial for those facing fewer or no other barriers. If the number of barriers faced follows a social gradient, with the most disadvantaged facing more barriers, then removing a single barrier to access could aggravate population-level inequalities. I call this "the Concurrent Barrier Hypothesis" (CBH). By formalising and naming "the Concurrent Barrier Hypothesis", this paper makes an important conceptual contribution to the public health and social epidemiology literature on healthcare access inequalities. The processes hypothesised by CBH are a potential mechanism for "macro" theories such as the Inverse Equity Hypothesis (Victora et al., 2000) and Fundamental Causes Theory (Link and Phelan, 1995), mechanisms which have been insufficiently formalised and tested to date (Krieger, 2001; Valles, 2018). CBH is also conceptually important because it includes government policy as a possible explanation for health inequalities, and explains how and why pro-inequalities policies could have unintended adverse effects.

The paper makes an empirical contribution to the healthcare inequalities literature, by empirically examining the hypothesis for the first time. The context selected for the empirical analysis is maternal healthcare access in Zambia. The study evaluates whether the association between each of six healthcare access barriers and giving birth in a health facility differs according to the number of other barriers faced, using data that covers every province in Zambia, over a five-year period. In doing so, the paper also contributes to the maternal healthcare access literature. The use of Geographic Information Systems (GIS) in this area is rapidly growing, with analysts linking population-level data to health facility lists (Ebener et al., 2015; Makanga et al., 2016; Matthews et al., 2019). However, such studies usually focus on one or two aspects of the health service environment, such as distance to care and/or quality of health services. This study uses geo-linked datasets at the population and facility-level to measure a comprehensive set of healthcare barriers, informed by established theoretical frameworks of "relational" healthcare accessibility (Ricketts and Goldsmith, 2005). Key informant interviews and a Zambia-focused literature review strengthen the selection of variables.

Evaluating the Concurrent Barrier Hypothesis in the context of maternal healthcare access is substantively important. Access to high-quality maternal healthcare is crucial for preventing maternal mortality and morbidity (Miller et al., 2016), which remains unacceptably high in many countries. Inequalities in access to maternal healthcare, particularly care in childbirth, are much larger than inequalities in access to child healthcare (Boerma et al., 2018; Hosseinpoor et al., 2011).

Zambia was selected as a case study for its relevance, representativeness and feasibility. The country's remarkable progress in increasing average levels of access to maternal healthcare and in reducing maternal mortality has not coincided with similar success in reducing disparities. While inequalities have reduced over time, they remain very high, with a 45 percentage point gap in access to maternal healthcare between women with no education relative to women with higher education, and a 50 percentage point gap for women in the lowest wealth quintile relative to the highest (Central Statistical Office (CSO) [Zambia] et al., 2014). Maternal health inequalities remain high despite the Government of Zambia prioritising the reduction of all health inequalities in its National Health Strategic Plans (Republic of Zambia Ministry of Health, 2017, 2011, 2009), and many health and health-related reforms have been initiated in Zambia over the past ten years with this objective in mind. Zambia is also a representative case. Relative to a set of 29 Sub-Saharan African countries that fielded Demographic Health Surveys between 2010 and 2015, Zambia has median levels of inequality in skilled birth attendance (Pons-Duran et al., 2016). Zambia also has high-quality geo-referenced secondary data on both maternal healthcare access and health facility infrastructure and staffing, making it feasible to explore the Concurrent Barrier Hypothesis empirically.

2. The Concurrent Barrier Hypothesis

Previous studies hypothesise that the poor are more likely to face multiple healthcare access barriers (Dzakpasu et al., 2014; James et al., 2006; McKinnon et al., 2015b); that removing a single barrier to access may not always be pro-poor (De Allegri et al., 2012; Handa et al., 2016; Lépine et al., 2017; Målqvist et al., 2013; McKinnon et al., 2015a; Penfold et al., 2007); and that targeting multiple barriers at once may be required in order for interventions to reduce healthcare access inequalities (Atchessi et al., 2016; Giedion et al., 2013; Jacobs et al., 2012; James et al., 2006; Uddin et al., 2012; Witter et al., 2016). There is some evidence that the effect of removing a single barrier to maternal healthcare access differs depending on socio-economic factors. For example, the effect of female autonomy on access to maternal healthcare has been shown to depend on the wealth of the household in Zambia (Banda et al., 2016); the effect of receiving maternal health advice depends on levels of education or wealth in Kenya (Fotso et al., 2009), and being closer to a health facility has different effects according to ethnicity in Guatemala (Pebley et al 1996, cited in: Gabrysch and Campbell 2009).

Inspired by these observations, this paper develops and formalises the "Concurrent Barrier Hypothesis". The Concurrent Barrier Hypothesis is composed of three conditions that are sufficient for the population-wide removal of one healthcare access barrier to increase population-level inequalities in healthcare access, keeping all else constant:

1. *If the worse off face more barriers than the better off, AND*
2. *If the worst off are not the only group to face any barriers, AND*
3. *If those who benefit the most from a single barrier being removed are those facing fewer or no other barriers, THEN:*

   Removing one barrier to healthcare access will increase population-level inequalities of healthcare access.

Leaving practical definitions of "worse off" and "better off" to the empirical section, Condition 1 establishes that the social gradient in the number of barriers faced must be in the opposite direction to the social gradient of healthcare access. If this condition holds true, and if those who benefit most from removing a single barrier to access are those who face fewer barriers (Condition 3), then groups who benefit most are those who already have greater levels of healthcare access.

In order for the removal of an access barrier to result in greater population-level inequalities, it must also be the case that the bottom of the socio-economic distribution is not the only group to face any barriers. Condition 2 is important in order to rule out the extreme case where removing a healthcare access barrier only benefits those at the bottom of the distribution because none of the more advantaged groups face any barriers.

The Concurrent Barrier Hypothesis provides a micro-level explanation for the macro-level trends described in the Inverse Equity Hypothesis and Fundamental Causes Theory: an inverse-U relationship between average levels of healthcare access and healthcare inequalities. The Concurrent Barrier Hypothesis suggests the following mechanism, which could coexist with others: as barriers to healthcare access are removed, those who face fewer other barriers benefit most. In the beginning of any given cycle, inequalities therefore increase as average levels of access increase. Eventually, those at the top of the socio-economic distribution no longer face any barriers, such that removing barriers now most benefits the bottom of the socio-economic distribution. In contrast to existing theories, the Concurrent Barrier Hypothesis places pro-equality policies and their unintended effects at the centre of the analysis, and identifies how, even when the state actively seeks to intervene and address unjust situations, inequalities can persist.

The Concurrent Barrier Hypothesis also makes potentially contradictory predictions to Fundamental Causes Theory. The latter posits that health inequities are inevitable because those with more power and resources will always have preferential access to the ever evolving new and scarce technologies that benefit or protect health (e.g.: sanitation, immunisation, chemotherapy). In a "barriers" context, Fundamental Causes Theory could imply that barriers have heterogeneous effects on healthcare access because better resourced population groups are better able to overcome these barriers. However, this implies that when barriers are removed, those who benefit most are the lesser resourced groups, for whom barriers had a greater impact in the first place.

3. Empirical case: framework and background

3.1. Theoretical framework of healthcare access

The empirical part of this study is based on a set of "relational" healthcare accessibility dimensions that describe the extent to which the health system is accessible relative to the population's varied needs, capacities and expectations, along different dimensions (Ricketts and Goldsmith, 2005). Merging three established "relational" healthcare accessibility frameworks results in six accessibility dimensions: availability, geographic accessibility, affordability, perceived quality of care, cognitive accessibility, and psychosocial accessibility (Table 1) (Bertrand et al., 1995; Penchansky and Thomas, 1981; UN, 2000). Low levels of accessibility on a given dimension (e.g. affordability) is defined as a barrier for that dimension (an affordability barrier).

Relational healthcare access frameworks establish healthcare access barriers as feasible sites of government intervention, in contrast to behavioural healthcare access models, which focus on individual-level modes of decision-making (e.g.: Andersen, 1995). The Concurrent Barrier Hypothesis is based on the premise that barriers can be removed or alleviated through public policy. Barriers are conceptualised as being modifiable through state action, even for those, such as the cognitive or

psychosocial barriers, that are often framed by the academic health literature or health policies as characteristics of 'ignorant', 'shy' or 'inefficacious' patients. Because health systems are fundamentally shaped by, and operate within, social relations of power that define patterns of social inclusion and exclusion, there is much that can be done within health systems to improve accessibility along these dimensions (Paper 3; Kabeer, 2000).

Table 1: Conceptual framework

ACCESSIBILITY DIMENSIONS	DEFINITIONS
Availability	"The relationship of the volume and type of existing services to the clients' volume and types of needs" (Penchansky and Thomas, 1981)
Geographic accessibility	"The relationship between the location of supply and the location of clients, taking into account client transportation resources and travel time, distance and cost" (Penchansky and Thomas, 1981)
Affordability	"The relationship of prices of services to the clients' income, ability to pay, and health insurance" (Penchansky and Thomas, 1981)
Perceived quality of care	Clients' perception of the extent to which they are likely to receive effective care once they access a facility
Cognitive accessibility	"Extent to which potential clients are aware if the locations of service (…) points and of the services available at these locations" (Bertrand et al 1995). Also includes clients' awareness of the benefits of quality biomedical care
Psychosocial accessibility	"Extent to which clients are constrained by psychological, attitudinal or social factors in seeking out (…) services" (Bertrand et al 1995). E.g.: shame; fear of disrespect from health workers and others; unacceptable care in the context of beliefs.

Note: Definitions are referenced where appropriate. Non-referenced definitions were developed by the author.

3.2. Maternal healthcare

The distribution of maternal mortality and morbidity is hugely unequal worldwide, both between and within countries: the lifetime risk of maternal death is 1 in 4900 in high-income countries, compared to 1 in 150 in low and middle-income countries and 1 in 36 in Sub-Saharan Africa (Graham et al., 2016). Healthcare access is particularly important for surviving childbirth. While a minority of women (5 to 15%) develop life-threatening complications during childbirth, many of these cannot be identified in advance. It is essential that mothers deliver with a skilled birth attendant, with adequate pathways for referral in the event of complications, in order to avoid death or morbidity for the mother and newborn (Miller et al., 2016). Although delivering in a health facility is no guarantee of quality, it is the safest option in contexts with too few midwives for home births and insufficient ambulances or good quality roads to transport women from home to hospital in an emergency (Campbell et al., 2016).

Inequalities in access to maternal healthcare are much larger than inequalities in access to child healthcare (Boerma et al., 2018; Hosseinpoor et al., 2011). This could be due to many factors, including gender inequity and the important cultural and sociological meanings of childbirth. Persistent inequalities are also linked to the fact that maternal healthcare can only be delivered by an accessible and effective health system. This contrasts with many child health interventions that can be delivered in the community through infrequent and targeted campaigns, such as vaccinations, oral rehydration, or protection against malaria-infected mosquitoes (Boerma et al., 2018).

3.3. Zambia

Sub-Saharan Africa (SSA) bears a disproportionate share of the global burden of poor maternal health (Alkema et al., 2016) and intra-country inequalities are high. Reducing inequalities in skilled birth attendance by bringing the poorest up to the level of the richest would eliminate at least half of the existing gap between average coverage and universal coverage in 25 Sub-Saharan African countries (Hosseinpoor et al., 2011).

Zambia is a lower-middle income country with a Total Fertility Rate (TFR) of 5.3 (Central Statistical Office (CSO) [Zambia] et al., 2014) over the study period. At 232 maternal deaths per 100,000 live

births in 2015, Zambia has lower levels of maternal mortality than the Sub-Saharan African average of 566 deaths per 100,000 live births in 2015, though its maternal mortality ratio remains more than 20 times higher than the European average (10 deaths per 100,000 live births in 2015) (WHO et al., 2019). The Demographic Health Survey used in this study estimates that 67.4% of women gave birth in health facilities in 2008-2013, a medium level for the region, up from 50.6% in 1992. 93% of women give birth in public rather than private health facilities (Central Statistical Office (CSO) [Zambia] et al., 2014). Women giving birth in health facilities primarily give birth in health posts and health centres (primary care level) where they should theoretically be assisted by nurses or midwives, while women with complications are referred to district or national level hospitals (secondary and tertiary care level).

Evans' (2018a) ethnographic study of the prioritisation of maternal health indicators within the Zambian health system demonstrates in detail how downward accountability structures, rooted in global pressures to achieve targets, have driven progress in improving average levels of facility delivery and reducing maternal mortality. Between 2009 and 2015, the Government's primary objective for maternal healthcare access was to increase rates of facility delivery from 48% to 65%, which was achieved. Another target was to increase the proportion of rural households living within 5km of the nearest facility from 54% in 2004 to 70% in 2015 (Republic of Zambia Ministry of Health, 2011). Strategies have included building 650 new health posts, promoting community-level Safe Motherhood Action Groups (SMAGs) operating in conjunction with community health workers trained to facilitate and encourage facility delivery, abolishing user fees, building maternity waiting homes, and providing unconditional cash transfers for children, the elderly and the disabled. These reforms have had mixed effects on inequalities. Removing user fees had no effect on inequalities of access, while unconditional cash transfers for families with children under five years old only increased access to facility delivery among women who lived in a village with a health facility (Handa et al., 2016; Lépine et al., 2017).

4. Methods

4.1. Data

This study links a population-level dataset to a facility-level dataset using Geographic Information Systems (GIS) methods, in order to adequately measure barriers defined at the intersection between local health service environments and population needs. This approach adds to innovative GIS analyses in maternal healthcare research by measuring a comprehensive set of healthcare access barriers instead of a small subset of barriers, as is common in the literature to date.

The health facility dataset is the 2010 Service Availability and Readiness Assessment (SARA), which collected data on all health facilities in 17 districts (out of 72). Public and private facilities of all levels were included in the census exercise. Data were collected on staffing, infrastructure, drugs and equipment at each health facility. The 17 districts were not randomly selected but are spatially spread out across all of Zambia's provinces, and include an even mix of predominantly rural versus urban districts. Malaria sentinel districts and Global Fund evaluation districts were purposefully included. Facilities without a valid geo-reference or where the geo-reference revealed the facility to be located outside one of the 17 SARA districts according to district shapefiles (Hijmans, 2015) were excluded. The final sample is comprised of 596 facilities. SARA surveys follow an internationally recommended methodology, based on interviews and direct observation (WHO, 2015). The consistency of the data is superior to that of the 2012 Zambia Master Facility List which, although it covers the entirety of Zambia, does not collect information on staffing or quality of care.

The population-level dataset is the 2013-14 Zambia Demographic Health Survey (DHS), which collects information from individuals, particularly women of reproductive age, and households. The

data is cross-sectional and representative at the national and provincial levels. All sampled women are asked where they delivered each live birth occurring in the previous five years. The data used in this study is at the birth level. The data are geo-referenced according to the location of the DHS sampling cluster, which is comprised of an average of 130 households. For confidentiality purposes, the DHS team randomly displaces geo-references within provinces by 0-2km for urban clusters and 0-5km for rural clusters (of which 1% is displaced up to a maximum of 10km). The analytical sample of births includes singleton births that occurred in the previous 5 years, were appropriately geo-referenced, and are linked to a mother residing in a SARA district who did not migrate since the birth. Non-singleton births were removed as they constitute a potential obstetric complication that is often diagnosed antenatally, for which the determinants of healthcare access will be fundamentally different. The final sample is comprised of 253 clusters and 2,988 live births. Sample selection for both datasets is further described in the Appendix 3.1.

4.2. Variables

In order to maximise validity and legitimacy, a Zambia-specific literature review and 12 key informant interviews (KII) (Appendix 3.2) were conducted in order to inform the selection of one variable per barrier concept (Table 2). Selected barrier variables were described and validated in a separate study using the same data (Paper 1 of this thesis), which found that the proposed set of barrier variables had very good levels of discriminatory accuracy with respect to facility delivery.

Table 2: Concepts, variables, and data sources

Concept	Variable definition	Data source
Maternal healthcare access	Whether a birth occurred in any health facility	DHS 2013-14
Affordability barrier	Mother's household was in the two poorest wealth quintiles at the time of interview	DHS 2013-14
Cognitive barrier	Birth has a birth order of two or above	DHS 2013-14
Psychosocial barrier	Birth has a birth order of six or above	DHS 2013-14
Geographic barrier	The mother's DHS sampling cluster at the time of interview was further than 10km from any health facility, measured as a straight-line distance	DHS 2013-14 & SARA 2010
Availability barrier	The mother's DHS sampling cluster at the time of interview was further than 10km from any health facility with at least one midwife, measured as a straight-line distance	DHS 2013-14 & SARA 2010
Perceived quality of care barrier	The mother's DHS sampling cluster at the time of interview was further than 10km from any health facility with the capacity to provide Comprehensive Emergency Obstetric Care, measured as a straight-line distance	DHS 2013-14 & SARA 2010

All barriers are binary variables. While the underlying accessibility dimension is a spectrum, defining variables as binary aids the empirical analysis by enabling clear identification of the number of other barriers faced, and by facilitating common support for the interaction terms (Hainmueller et al., 2018). Descriptive statistics are provided in Table 3.

The affordability, cognitive, and psychosocial barriers could not be directly measured at the intersection of population needs and health services. Instead, they are measured here according to characteristics that we know are discriminated against (or not accommodated) in the Zambian health system. For example, while user fees have in theory been eliminated, the cost of delivering in a health facility remains high compared to average rural incomes (Kaiser et al., 2019b). Similarly, the KIIs and

literature review confirmed that women with birth orders of 2 and above are more likely to believe that they are not at risk of obstetric complications, which is a misconception (Mulenga et al., 2018). Women with birth orders of 6 and above are more likely to be discriminated against by nurses and midwives who judge them negatively for their high fertility (Paper 3 of this thesis).

"Removing" the affordability, cognitive and psychosocial barriers does not imply making people richer or reducing their fertility, but rather creating a health service environment where wealth or birth order are not a factor of social exclusion. In practice, this could mean ensuring that all necessary materials for giving birth are provided to birthing women by the healthcare system; creating programmes to subsidise the cost of transport to the facility; effectively communicating to women through community-based channels that while complications are indeed less likely for multi-parous mothers, life-threatening complications can occur at any parity; and providing education, supportive supervision, and management to health workers that succeeds in protecting all women's right to respectful healthcare, regardless of their social position or circumstances.

The geographic, availability and quality of care barriers were defined according to a straight-line distance of 10km (i.e. "as the crow flies"), rather than a networked distance that takes the shortest path across a given road network. Zambian national health strategy targets seek to ensure that every rural household is within 5km of a health facility. However the random displacement of DHS sampling clusters described above means that an analytical distance of 10km is recommended for analysis in order to minimise the number of births coded as facing a geographically defined barrier when they don't, and vice-versa (Burgert and Prosnitz, 2014; Wang et al., 2015). The straight-line distance is preferred to a networked distance for several reasons: the measurement error inherent in the random displacement of the DHS geo-references means that networked distance is unlikely to be more accurate; there is no information on individual-level mode of transport, such that networked distance cannot be converted to speed; and data on unpaved roads could not be accessed for this analysis.

Some barriers are nested by virtue of how they are measured. By construction, women facing the geographic barrier will also face the availability and perceived quality of care barriers, and women facing the availability barrier also face the perceived quality of care barrier. This is because if a woman lives further away than 10km from any facility (geographic barrier), she also lives further than 10km away from any facility with a midwife (availability barrier). Similarly, CEMONC-level care (quality of care barrier) is not feasible without skilled midwifery professionals (this makes substantive sense and is also borne out by the data). Finally, any woman facing the psychosocial barrier (6 births +) will necessarily face the cognitive barrier (2 births +).

Table 3: Descriptive statistics, Zambia DHS (2013-14) & SARA (2010)

	Complete case sample *Unweighted*	Original dataset
	% of births	***% of births (DHS)*** *Weighted*
Facility delivery	73.9%	67.4%
Affordability barrier *Two poorest wealth quintiles*	42.7%	47.8%
Cognitive barrier *Birth order 1 +*	81.0%	74.7%
Psycho-social barrier *Birth order 6 +*	24.9%	16.3%
	% of births	***% of facilities (SARA)*** *No weights*
Geographic barrier *No health facility within 10km*	21.0%	
Availability barrier *No midwife*		55.9%
No midwife within 10km	38.1%	
Quality of care barrier *Not CEMONC*		95.1%
No CEMONC within 10km	56.8%	

4.3. Empirical strategy

4.3.1. Conditions 1 & 2

"Population-level inequalities" and the "wors(t/e) off" in CBH Conditions 1 & 2 are defined according to three socio-economic dimensions for which a healthcare access gradient is observed in Zambia: education, wealth or rural-urban residence (Table 4). These attributes are also sociologically meaningful in the Zambian context (Phiri and Abebe, 2016; White and Jha, 2018).

The first two conditions in the Hypothesis are assessed by evaluating how the barriers are distributed across education, wealth and rural-urban residence groups, using histograms and smoothed kernel density plots. Contextually meaningful cut-off points are used to define these groups. The educational groups are: no education, primary education, secondary education and tertiary education. The wealth groups are defined with respect to household quintiles, as is common in the health literature. Rural-urban residence is defined as two groups, according to the DHS' allocation of sampling clusters to either rural or urban residence. I also conduct a test of stochastic dominance using Somers' D in order to draw statistical inferences about the distribution of barriers across socio-economic groups, with respect to a binary classification of the groups (some secondary education and above or below; bottom two wealth quintiles or above; urban or rural) (Appendix Table A3.1).

4.3.2. Condition 3

Condition 3 posits that the effect of removing a given barrier on the probability of facility delivery is greater for those facing fewer other barriers. It also implies that there is at least some positive effect of removing a barrier on healthcare access for at least some group.

This paper empirically evaluates this condition through an observational, rather than causal, approach. It is difficult to definitively test the hypothesis, which posits that the causal effect of removing healthcare access barriers on access to healthcare depends on the number of other barriers.

A causal inference approach would likely be restricted to estimating the heterogeneous effect of removing a single barrier, since the removal of the barrier would have to be randomised, either by the researcher or through a natural experiment. Furthermore, a randomised control trial of the hypothesis would likely have low external validity. This paper therefore aims to establish the plausibility of the hypothesis, in order to justify more focused causal tests.

Condition 3 was evaluated for each barrier separately, using binomial logistic regression, by interacting exposure to the barrier of interest with the number of other barriers faced.

$$Equation\ 1\text{: } \log\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1 barrier_i + \beta_2 barnumber_i + \beta_3 barrier_i * barnumber_i + \theta_i$$

π is the probability that birth i takes place in a facility, *barrier* is a binary variable indicating whether birth i is exposed to the barrier whose heterogeneous effect is being evaluated, *barnumber* is a vector of dummies indicating the number of other barriers faced apart from the barrier of interest, and θ is a vector of control variables. The other barriers counted in *barnumber* are not included as controls, as these variables would be collinear with the *barnumber* dummies. Errors are clustered at the DHS sampling cluster level. In order to visualise the results, the Stata 14 *margins* command is used to display the predicted probability of facility delivery for those who face a given barrier and those who don't, by the number of other barriers faced. If Condition 3 is met, we would expect to see a larger difference in the probability of facility delivery between those who face a given barrier and those who don't, for those who face a lower number of other barriers. Positive interaction terms indicate that facing a greater number of other barriers relative to the *barnumber* reference category makes the association between the barrier of interest and facility delivery less negative (i.e. less strong). Interaction terms consistent with Condition 3 of the Concurrent Barrier Hypothesis would therefore be positive and would increase in magnitude for each level of *barnumber* (Figure 1). Interaction terms directly contradicting Condition 3 of the Concurrent Barrier Hypothesis would be negative and would become more negative for each level of the *barnumber* dummies (Figure 2).

Figure 1: Pro-CBH pattern (Condition 3)

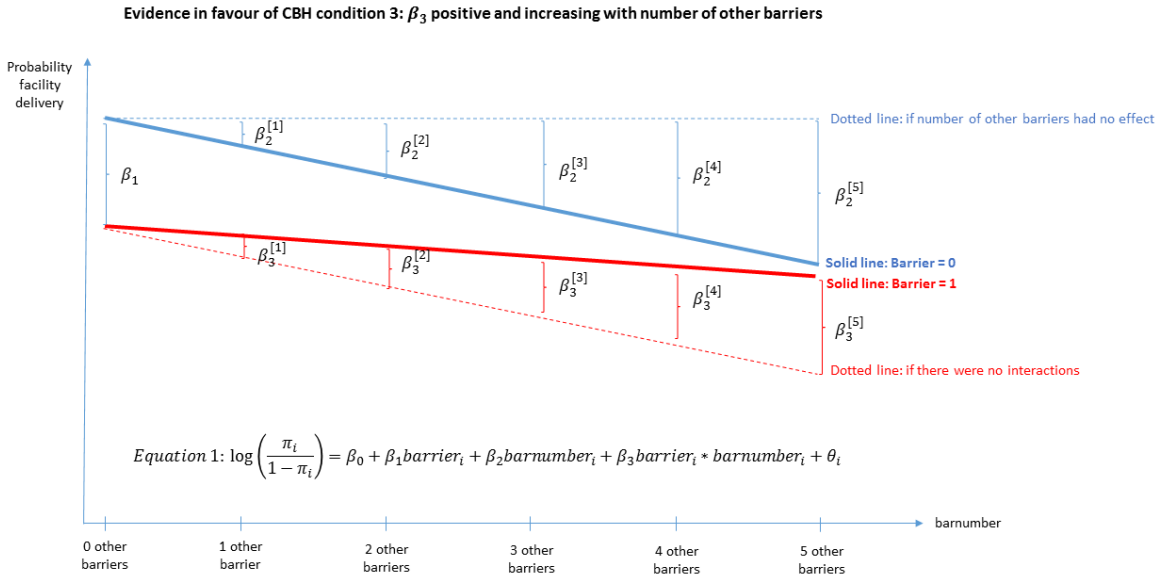
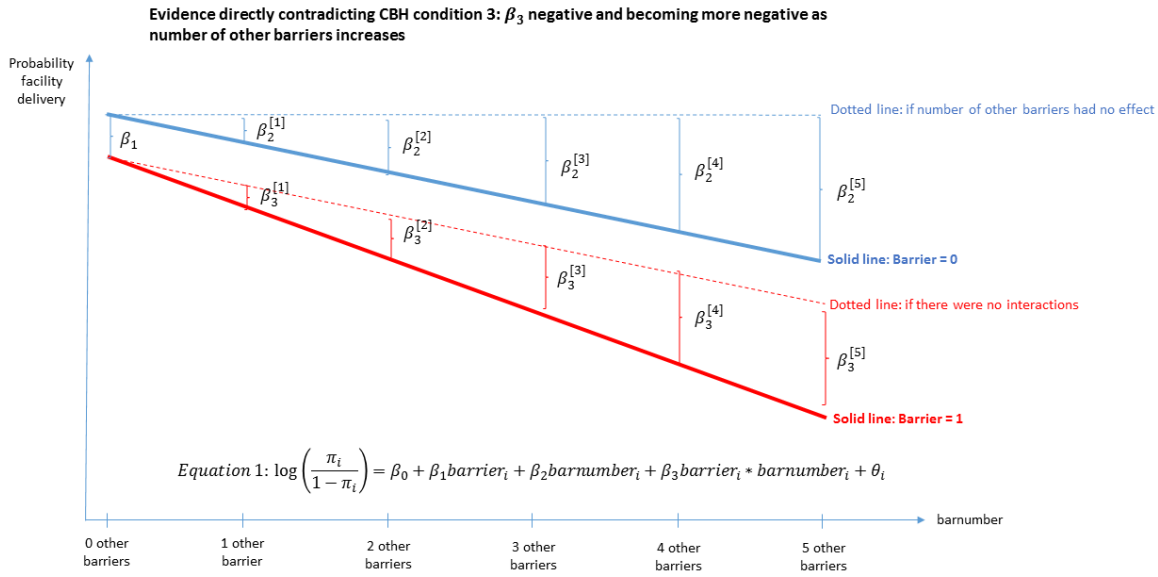


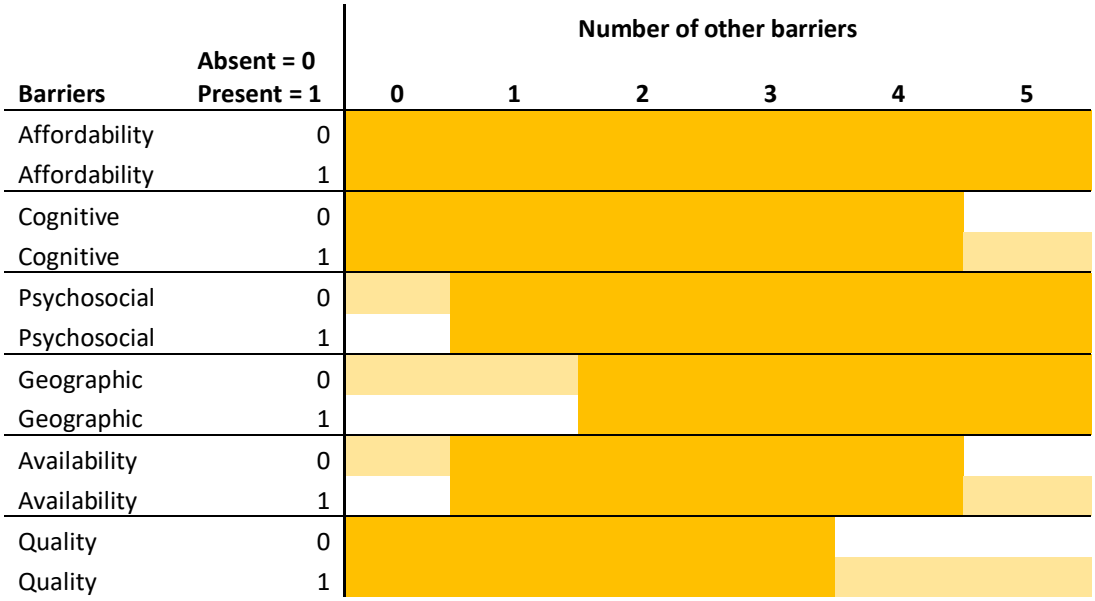
Figure 2: Anti-CBH pattern (Condition 3)



The analysis examines the heterogeneous effect of a given barrier, e.g. affordability, across different levels of "number of other barriers faced". In order for the analysis to be feasible, it must be the case that, for each number of "other barriers", there is a non-zero sample of births who face the affordability barrier and a non-zero number of births who do not face the affordability barrier. Otherwise, the "effect" of the affordability barrier cannot be estimated. Because some barriers cannot be experienced without others, each barrier has a different number of "other barriers" across which the association between the barrier and facility delivery can be compared (Figure 3). The affordability barrier is the only barrier with the full range of comparison from 0 other barriers to 5 other barriers, because it is entirely independent from other barriers. The effect of the cognitive barrier is compared from 0 other barriers to 4 other barriers. It is not possible to face 5 other barriers when the cognitive

barrier is absent because experiencing the psychosocial barrier also implies facing the cognitive barrier. The effect of the psychosocial barrier is compared from 1 other barrier to 5 other barriers: it is not possible to face the psychosocial barrier alone, and therefore impossible to simultaneously face the psychosocial barrier and zero other barriers. Similarly, the geographic barrier goes from 2 other barriers to 5 other barriers, the availability barrier from 1 other barrier to 4 other barriers, and the quality barrier from 0 other barriers to 3 other barriers.

Figure 3: Number of other barriers faced when a given barrier is present vs. absent.



Note: Dark shading indicates that there is a non-zero number of births for BOTH barrier=1 AND barrier=0 for a given number of "other barriers". Light shading indicates a non-zero number of births for a given number of "other barriers" for EITHER barrier=1 OR barrier=0. The only cells that can be used for analysis are those with dark shading.

In order to reduce omitted variable bias and enable stronger causal interpretation, a set of control variables θ_i is included in the regression. These are variables that are thought to be associated with the outcome, facility delivery, and with the barrier variables. Based on key informant and in-depth interviews (described in Paper 1 and Paper 3 respectively), as well as the maternal healthcare access literature in Zambia and other countries in Sub-Saharan Africa, the following variables were included: mother's education (at least some secondary education vs. not); mother's age at birth; whether there was more than one woman of reproductive age in the household; whether the mother is married; community norms regarding decision-making about wife's healthcare[16]; and mother's professional occupation (agricultural occupation; not working; all other occupations) (Banda et al., 2016; Gabrysch and Campbell, 2009; Sialubanje et al., 2014b). Variables that measure the barrier concepts in a different way were not considered for inclusion as controls. Rural-urban residence was excluded as it is collinear with the quality of care barrier. Apart from mother's age at birth, all variables are measured at the time of interview, as they were not available at the time of birth.

4.4. Limitations

Each of the barriers is a complex concept (Table 1), which is impossible to fully capture with a single variable. In order to partially address this limitation, a Zambia-specific literature review and 12 key informant interviews (Appendix 3.2) were conducted in order to select the best context-specific variable for the concept out of all available options.

[16]See Appendix 3.3 for a full explanation of this variable.

One socio-economic dimension used to test Conditions 1 and 2, wealth, is also used as a variable to measure the barrier concept of affordability, because data on the formal and informal costs of facility delivery for each health facility are not available. By construction, poorer populations will therefore face at least one more barrier than richer populations. However, conditions 1 and 2 of the Concurrent Barrier Hypothesis are also evaluated on two other dimensions of socio-economic status where this limitation is not present (education and rural-urban residence). Furthermore, wealth constitutes the best available measure of affordability, since it strongly affects income-generating options (Phiri and Abebe, 2016), which in turn affect families' ability to cover the costs of facility delivery in Zambia (Kaiser et al., 2019b).

The cognitive and psychosocial barriers are measured using different levels of the same variable, birth order, which calls into question whether this operationalization succeeds in measuring two different barriers. However, key informant interviews, in-depth interviews with women who recently gave birth in Zambia, and a Zambia-focused literature review all confirm that there is widespread support for both the cognitive and psychosocial implications of birth order. The empirical results also suggest that there is a significant difference in the logged odds of facility delivery between facing the cognitive barrier only and facing both the cognitive and psychosocial barriers (Appendix Table A3.2). Furthermore, the heterogeneous effects of the cognitive barrier (across number of other barriers faced) follow the opposite pattern to that of the psychosocial barrier (Figure 5).

The random jittering of the DHS' geo-references generates measurement error for the three barriers that are geographically defined. It is not possible to establish whether this measurement error will cause over- or under estimation. Given the 10km barrier definition and the jittering "rules" (ignoring, for the sake of presentation, the 1% of the sample that can be displaced up to 10km), all rural clusters observed within 5km of any facility will be correctly classified as not facing the geographic barrier. All clusters observed further than 15km from any facility will be correctly classified as facing the geographic barrier. Clusters observed within 5 to 15km from any facility could be correctly classified, be a false positive, or be a false negative. For urban clusters, the same logic applies, except that the bandwidth for potential misclassification is 8 to 12km. Despite this limitation, linking DHS and health facility data is widely recommended in the global health literature as a way to understand the relationship between health service environments and individual outcomes. This paper follows best practice in terms of defining thresholds of access to minimize classification errors (Burgert and Prosnitz, 2014; Matthews et al., 2019; Wang et al., 2015).

5. Results

5.1. Testing CBH condition 1 and 2: distribution of barriers across socio-economic dimensions

As specified above, conditions 1 and 2 of CBH are as follows:

Condition 1: The worse-off face more barriers than the better-off

Condition 2: The worst-off are not the only group to face any barriers

If either of these conditions are not met, removing a single access barrier for the whole population could improve (or not affect) socio-economic inequalities of access, even if those who benefit the most from barrier removal are those facing the fewest barriers (condition 3). Therefore, it is essential for the Concurrent Barrier Hypothesis that these conditions hold.

Evidence of the distribution of barriers across socio-economic levels shows that worse-off groups face a greater average number of barriers than better-off groups (Table 4). If those facing a greater

number of barriers benefit less from barrier removal, then the socio-economically disadvantaged groups (the less educated, the poor, and rural residents) will be the ones to benefit less. Figure 4 shows that the worst-off groups are not the only groups to face any barriers, and that while the better off are likely to face fewer barriers, they do face some. The better off would therefore disproportionately benefit from a policy that removed these barriers for the entire population if condition 3 were shown to be true. A test of stochastic dominance, Somers' D, confirms these conclusions: a randomly selected birth to a mother who is more disadvantaged (poor, rural or less educated) is significantly more likely (at the 0.1% level) to face a higher number of barriers than a birth to a mother who is better off (Appendix Table A3.1).

Table 4: Average number of barriers and healthcare access gradient

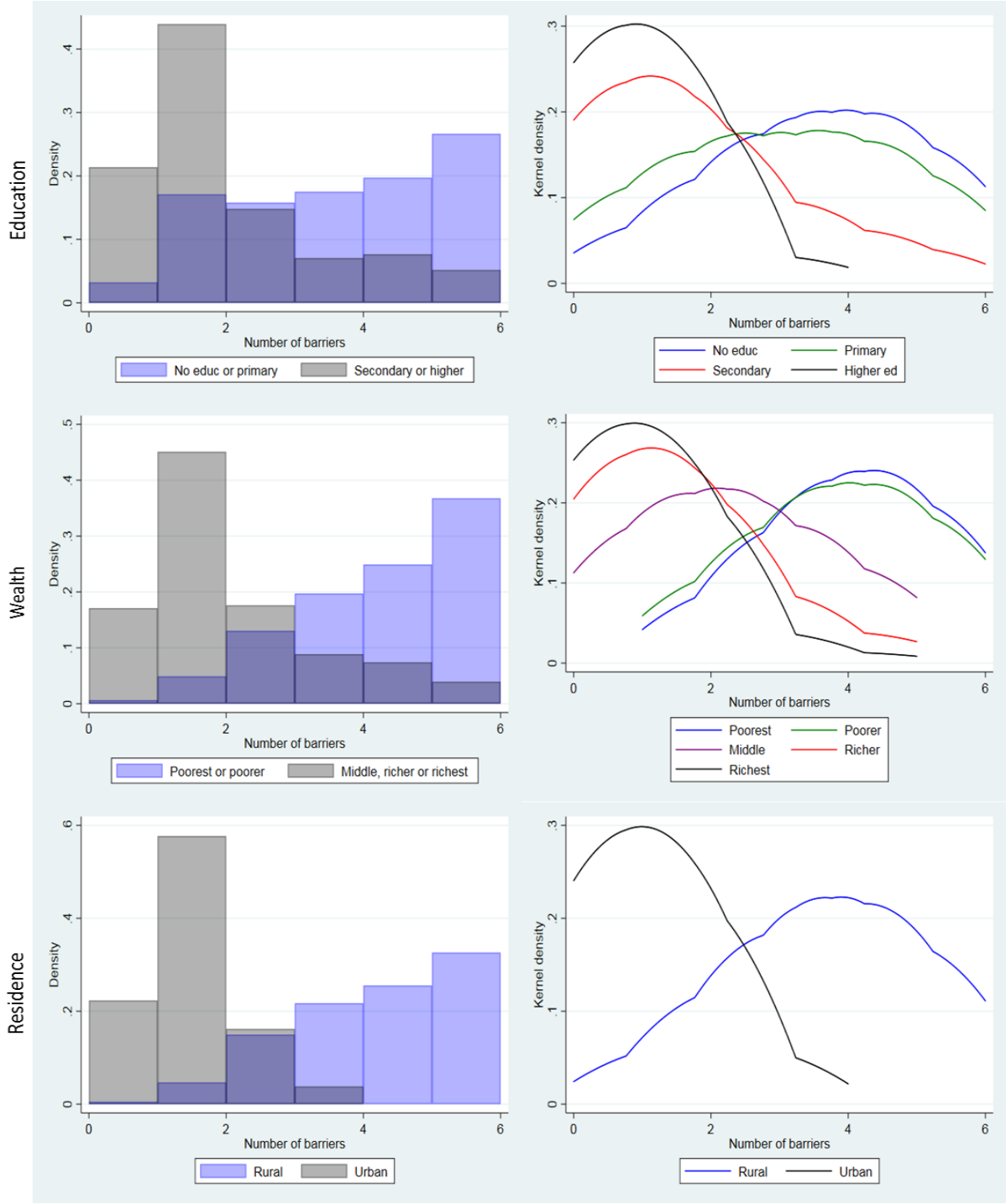
Education level	Average number of barriers	% facility delivery
No education	3.7	60.8
Primary	3.1	67.5
Secondary	1.6	87.2
Higher education	1.0	98.5

Wealth level	Average number of barriers	% facility delivery
Poorest	4.1	56.4
Poorer	4.0	62.5
Middle	2.3	73.4
Richer	1.4	86.5
Richest	1.0	95.7

Residence	Average number of barriers	% facility delivery
Rural	3.7	61.0
Urban	1.0	92.8

***Note**: complete case sample, unweighted*

Figure 4: Distribution of number of barriers faced by education, wealth and residence



5.2. Evaluating CBH condition 3: heterogeneity of barrier effects by number of other barriers

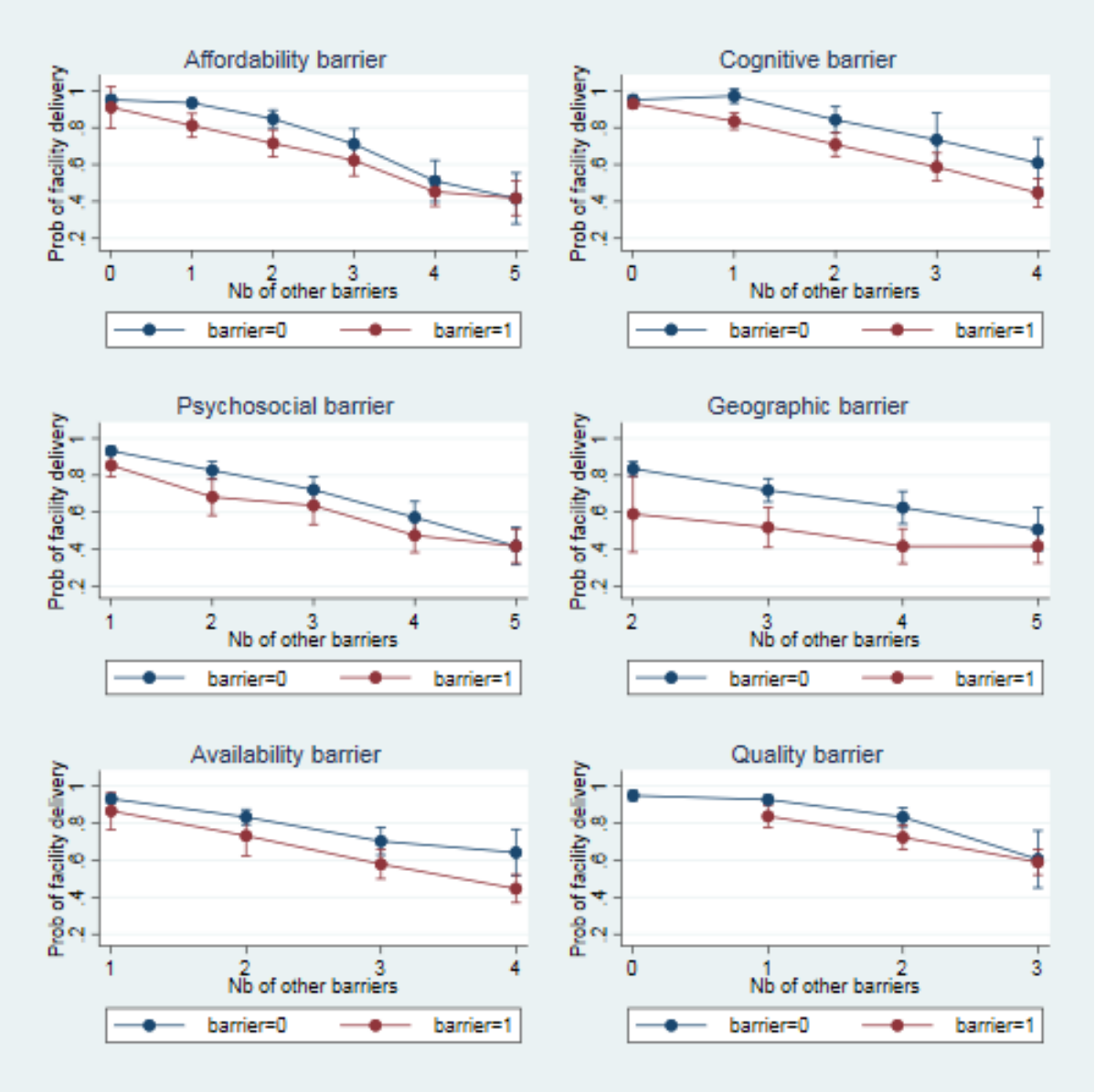
Condition 3 of the Concurrent Barrier Hypothesis is as follows:

> *Condition 3: If those who benefit the most from a single barrier being removed are those facing fewer or no other barriers*

Prior to evaluating Condition 3, I confirm that each barrier is negatively and significantly associated with facility delivery, even when other barriers and control variables are included in the model (Appendix Table A3.2). Converting coefficients to odds ratios, each barrier is associated with a 26 to 56 percent decrease in the odds of facility delivery, keeping other barriers and control variables constant.

Patterns are visually assessed in Figure 5 (without controls). Figure 5 shows the probability of facility delivery for those who face a specific barrier and those who don't, according to the number of other barriers faced. As expected, those exposed to a given barrier (the red line) have a lower probability of facility delivery than those not exposed to the same barrier (the blue line), for each number of other barriers faced, although confidence intervals often overlap. As the number of other barriers faced increases, the probability of accessing a facility delivery decreases. The geographic barrier and the quality of care barrier appear to be characterised by a pattern consistent with CBH: the difference in probability between those who face the given barrier and those who don't seems to decrease with the number of other barriers are faced (i.e. the difference between the blue line and red line is larger at the left of the graph than at the right). The cognitive barrier and the availability barrier display patterns that appear to contradict CBH: the difference in probability between those who face the given barrier and those who don't seems to increase with the number of other barriers are faced. The remaining two barriers, the affordability and psychosocial barriers, present inconclusive patterns.

Figure 5: Probability of facility delivery by specific barrier and number of other barriers faced. Zambia 2013-14.



Note: Controls not included, errors clustered at the DHS sampling cluster, complete case sample

Table 5 inspects these patterns more closely. The main effects (β_1 in Equation 1) show that when no other barrier (or the minimum number of other barriers) is present, facing a given barrier is significantly associated with lower logged odds of facility delivery compared to those not facing any barriers (or the minimum number of other barriers), in the psychosocial, geographic, and quality of care barrier models. This association is also negative in the other three models, but not statistically significant. Facing a greater number of other barriers when the barrier of interest is not present (β_2 in Equation 1) is significantly associated with lower facility delivery in all models, although the difference between facing no other barriers and facing one other barrier is not significant for the affordability or cognitive barrier models. The fact that facing a greater number of barriers is negatively associated with facility delivery suggests that the barrier variables are measuring important dimensions of access.

The coefficients on the interaction terms for the psychosocial, geographic and quality barriers[17] (β_3 in Equation 1) are positive and progressively increase relative to the reference category (with an exception for the "4 other barriers" interaction in the psychosocial barrier model with controls), which is in line with condition 3 of CBH. The affordability, cognitive and availability barrier models have negative coefficients on some or all interaction terms, though these do not become consistently more negative as the number of other barriers faced increase.

Most of the interaction terms are not significant. This is not surprising given fairly limited sample sizes within each comparison "cell" (Appendix Table A3.3). Exceptions include: (1) The "effect" of the psychosocial barrier on the logged odds of facility delivery is significantly weaker (at the 5% level) when facing five other barriers compared to facing only one other barrier (the reference category), in models with and without controls; (2) The "effect" of the geographic barrier on the logged odds of facility delivery is significantly weaker (at the 5% level) when facing five other barriers compared to facing two other barriers (the reference category), in the model with controls; (3) The "effect" of the quality barrier on the logged odds of facility delivery is significantly weaker (at the 10% level) when facing three other barriers compared to facing one other barrier (the reference category), in the model without controls.

[17] As shown in the bottom right panel of Figure 5, the probability of facility delivery when the quality barrier is present and zero other barriers are faced cannot be estimated because all births in that cell accessed a facility delivery. Therefore, the interaction term for: "0 other barriers # barrier=1" cannot be estimated and the next interaction is selected as the reference category.

Table 5: Association between barriers and facility delivery given number of other barriers faced. Logit coefficients.

	AFFORDABILITY		**COGNITIVE**		**PSYCHOSOCIAL**		**GEOGRAPHIC**		**AVAILABILITY**		**QUALITY**	
Facility delivery	no controls	with controls	no controls	with controls	no controls	with controls	no controls	with controls	no controls	with controls	no controls	with controls
Barrier of interest=1	-0.638 (0.757)	-0.144 (0.790)	-0.377 (0.288)	-0.393 (0.292)	-0.852*** (0.282)	-0.637** (0.286)	-1.257*** (0.459)	-1.593*** (0.419)	-0.748 (0.476)	-0.750 (0.523)	-0.913*** (0.278)	-0.814*** (0.298)
0 other barriers	*Reference cat*		*Reference cat*		*NA*		*NA*		*NA*		0.386 (0.287)	0.439 (0.293)
1 other barrier	-0.310 (0.288)	-0.300 (0.291)	0.556 (0.765)	0.804 (0.762)	*Reference cat*		*NA*		*Reference cat*		*Reference cat*	
2 other barriers	-1.228*** (0.334)	-1.128*** (0.344)	-1.272*** (0.396)	-1.079*** (0.415)	-1.055*** (0.234)	-0.886*** (0.250)	*Reference cat*		-1.011*** (0.211)	-0.824*** (0.220)	-0.945*** (0.231)	-0.761*** (0.225)
3 other barriers	-2.043*** (0.351)	-1.809*** (0.386)	-1.929*** (0.475)	-1.677*** (0.498)	-1.664*** (0.241)	-1.490*** (0.270)	-0.682*** (0.180)	-0.615*** (0.185)	-1.759*** (0.241)	-1.489*** (0.262)	-2.127*** (0.362)	-1.803*** (0.373)
4 other barriers	-2.897*** (0.367)	-2.661*** (0.398)	-2.496*** (0.404)	-2.205*** (0.400)	-2.327*** (0.245)	-2.095*** (0.269)	-1.111*** (0.238)	-0.940*** (0.252)	-2.036*** (0.325)	-1.707*** (0.348)	*NA*	
5 other barriers	-3.277*** (0.407)	-2.993*** (0.459)	*NA*		-2.953*** (0.269)	-2.706*** (0.269)	-1.595*** (0.287)	-1.328*** (0.321)	*NA*		*NA*	
0 other barriers # barrier=1	*Reference cat*		*Reference cat*		*NA*		*NA*		*NA*		*Not estimable*	
1 other barrier # barrier =1	-0.537 (0.765)	-0.676 (0.785)	-1.504** (0.763)	-1.557** (0.755)	*Reference cat*		*NA*		*Reference cat*		*Reference cat*	
2 other barriers # barrier =1	-0.158 (0.807)	-0.460 (0.828)	-0.404 (0.386)	-0.308 (0.378)	0.0559 (0.355)	0.0660 (0.361)	*Reference cat*		0.146 (0.540)	0.168 (0.569)	0.266 (0.328)	0.191 (0.319)
3 other barriers # barrier =1	0.240 (0.800)	-0.142 (0.830)	-0.284 (0.445)	-0.212 (0.444)	0.459 (0.369)	0.446 (0.369)	0.390 (0.508)	0.589 (0.468)	0.205 (0.524)	0.209 (0.559)	0.848* (0.447)	0.674 (0.444)
4 other barriers # barrier =1	0.404 (0.802)	-0.00746 (0.829)	-0.283 (0.377)	-0.262 (0.369)	0.461 (0.342)	0.389 (0.352)	0.409 (0.544)	0.676 (0.501)	-0.0512 (0.584)	-0.0876 (0.612)	*NA*	
5 other barriers # barrier =1	0.642 (0.818)	0.155 (0.848)	*NA*		0.853** (0.362)	0.763** (0.355)	0.895 (0.555)	1.228** (0.534)	*NA*		*NA*	
Constant	2.941*** (0.287)	2.382*** (0.456)	2.941*** (0.287)	2.253*** (0.452)	2.620*** (0.166)	2.391*** (0.461)	1.625*** (0.146)	2.035*** (0.421)	2.620*** (0.166)	1.988*** (0.426)	2.555*** (0.166)	1.796*** (0.434)
Observations	2988	2988	2818	2818	2709	2709	1928	1928	2539	2539	2362	2362

Note: Robust clustered standard errors in parentheses * $p < .1$, ** $p < .05$, *** $p < .01$

6. Discussion

This paper proposes, formalises and empirically examines the Concurrent Barrier Hypothesis. The empirical analysis evaluates the conditions under which removing one access barrier for all groups may aggravate healthcare access inequalities instead of improving them. Findings demonstrate that the worst-off are not the only ones to face any maternal healthcare access barriers in Zambia, but that they are more likely to face a greater number of access barriers than the better-off. This is true for three different dimensions of socio-economic status: wealth, education, and rural-urban residence. The association between the psychosocial, geographic and quality barriers and facility delivery is stronger the fewer other barriers are present. For the other three barriers (affordability, cognitive and availability), the pattern is unclear but may operate contrary to CBH, particularly for the cognitive and availability barriers.

The empirical strategy includes control variables in order to reduce omitted variable bias and approximate a test of the heterogeneous causal effects implied by Condition 3 of the Concurrent Barrier Hypothesis. True causal effects cannot be obtained through an empirical strategy that allows for examination of CBH for all barriers, over a wide geographical area and time period. These findings show tentative support for the Concurrent Barrier Hypothesis in the case of the psychosocial, geographic and quality of care barriers.

Why do some barriers fit the predictions of the CBH while others do not? Accessibility dimensions that fit the predictions of the CBH (e.g.: geographic) required other accessibility dimensions to be present in order to have a strong effect themselves. It appears that in the Zambian context, being near a facility is not sufficient for a woman to access care if - for example - she cannot afford the materials that she is expected to bring to the birth, or if she expects to be discriminated against by healthcare workers for having "too many" children. Conversely, accessibility dimensions that potentially contradict the CBH (e.g. cognitive accessibility) have a stronger effect when they operate by themselves; once other accessibility dimensions are present, their effect becomes weaker. One explanation could be that perceptions of heightened risk around the first birth are highly effective in pushing women who face many other barriers to access a facility delivery. Once more accessibility dimensions are in place, women with higher order births may catch up relative to primiparous women, since the lower perceived risk of a higher-order birth is compensated by the fewer sacrifices required to access a facility birth. In summary, the different results obtained might be explained by whether accessibility dimensions are complementary to each other in a particular context, or substitutes for one another.

The policy implications of the Concurrent Barrier Hypothesis are not straightforward and depend on a government's broader political orientation toward universalism versus targeting. In contexts (and for the specific barriers) where the Concurrent Barrier Hypothesis holds, one possibility to safeguard the pro-equality effects of removing a single barrier to access would be to remove said barrier for the most disadvantaged population groups only. For example, in the case of an interaction between the geographic and affordability barriers, this could involve providing vouchers for transport and maternal health services to low-income women living in remote areas. Such an intervention has been trialled in Cambodia, Bangladesh, Uganda, Pakistan and India, successfully increasing the proportion of women giving birth in a facility (Bellows et al., 2013). However, opponents of targeting would point out that targeted approaches to improving equality can have perverse political economy effects, making it more likely that pro-poor policies will be dismantled in the future by a majority of the electorate that does not benefit (Mkandawire, 2005). Proponents of universalism would therefore respond to the Concurrent Barrier Hypothesis by jointly removing interacting barriers for the entire

population. While more expensive and logistically ambitious, such an approach may yield greater overall gains, both in terms of equity and average progress.

The Concurrent Barrier Hypothesis is particularly relevant for geographic areas or healthcare issues where "the worse off face more healthcare access barriers than the better off" and "the worst-off are not the only group to face any barrier". In other words, similarly to the case of maternal healthcare access in Zambia, not everyone faces all barriers, there is a social gradient in barriers, but barriers are not restricted to the bottom of the distribution. In the case of maternal healthcare access, these conditions likely apply to many low-income and lower-middle income countries, as opposed to upper-middle income countries, where the upper classes may no longer face any barriers.

CBH could also be applicable to domains beyond health, such as education, access to jobs, or voting. In short, any private or public good where access is hindered by barriers, where barriers could be alleviated by government action, and where the social distribution of barriers follows the patterns outlined above. The process whereby public services, such as active labour market policies or childcare services, are monopolised by the more advantaged has been called a "Matthew effect" in the European social policy literature (Bonoli and Liechti, 2018; Pavolini and Van Lancker, 2018). However, the role of interactions between barriers as a mechanism behind Matthew effects has, to the best of my knowledge, not yet been explored.

This study suggests a number of additional research agendas. First of all, this empirical analysis should be replicated in other healthcare contexts and other social policy areas, ideally with larger sample sizes. Secondly, it will also be important to confirm the results of this study using causal inference methods, one barrier at a time. Thirdly, the Government of Zambia has already implemented a number of policies that have alleviated barriers to healthcare access. Some of these policies' equity effects have been evaluated using causal inference methods, but independently from each other. This study suggests that there may be value in evaluating such policies jointly rather than separately. Fourthly, further research should evaluate the Concurrent Barrier Hypothesis from a macro as well as a longitudinal perspective, studying the evolving social distribution of barriers over time, and analysing the potentially heterogeneous consequences of barrier removal for groups facing different sets of barriers.

7. Conclusion

This study puts forward the Concurrent Barrier Hypothesis for the first time, using maternal healthcare access in Zambia as an empirical case. Under a causal interpretation, findings suggest that independently alleviating the psychosocial, geographic, or quality of care barriers for the entire population may increase population-level inequalities of access. Results for the other barriers are inconclusive. The Concurrent Barrier Hypothesis should be further evaluated in contexts where: barriers exist, not everyone faces all barriers, there is a social gradient in barriers, and barriers are not restricted to the bottom of the distribution. These contexts include healthcare access but could be as diverse as education, employment, and democratic participation. This paper calls for heightened awareness of potential interactions between access barriers, and recommends that, where the Concurrent Barrier Hypothesis holds, barriers be jointly removed or that priority be given to the most disadvantaged groups in society. The Concurrent Barrier Hypothesis directly engages with highly influential macro theories of health inequalities, the Inverse Equity Hypothesis and Fundamental Causes Theory, providing both mechanisms and potentially competing predictions. In contrast to existing theories, it places pro-equality policies and their unintended effects at the centre of the analysis, and explains how, even when the state actively seeks to intervene and address unjust situations, inequalities can persist.

Appendix 3.1: Sample selection

In the DHS dataset, births to mothers who migrated since the birth were excluded, as their residence at the time of the birth could not be obtained (21,034 excluded out of an original sample of 49,207). Non-singleton births were excluded since they constitute a medical complication that is often identified prior to the birth, such that the determinants of access to care in childbirth are fundamentally different to non-singleton births (496 excluded out of 28,173). Births that occurred prior to 2008 were excluded, as the location of the birth was not recorded in the survey (16,392 excluded out of 27,677). Births that did not have a valid geo-reference were excluded (two sampling clusters and 45 births out of 11,285). Births that were not located in one of the 17 SARA districts were excluded (466 sampling clusters and 7,671 births out of 11,240). Finally, observations with missing values on any variable were excluded (581 out of 3569), leaving a final, complete case analysis sample of 2,988 observations. 80% of observations missing a value on any variable were only missing a value on the outcome variable, location of facility delivery.

In the SARA dataset, originally composed of 658 facilities, 17 facilities were dropped due to having no or incorrect geo-references and 45 were excluded due to being identified as located outside of the SARA districts' shapefiles through GIS analysis. The final sample was composed of 596 facilities.

Appendix 3.2: Key informant interviews

12 key informant interviews (KII) were held in Lusaka in July-August 2017 with respondents from academic, government, international aid, and medical backgrounds, selected purposively for their knowledge of healthcare access in Zambia. Ethical clearance for this study was obtained from the London School of Economics Ethics Committee [ref. 000576] and the University of Zambia Biomedical Research Ethics Committee [ref. 005-06-17]. KIIs focused on the validation of the overall theoretical framework, the selection of the variables from a shortlist provided by the author, additional variable suggestions, and discussion of the strengths and weaknesses of potential variables. The respondents were asked to assess potential variables according to their conceptual closeness to a given dimension and to the availability of high-quality secondary data measuring this variable in the Zambian context. More information is available in Chapter 6 of this thesis.

Appendix 3.3: Autonomy variable

The autonomy variable was defined at the community level in order to keep non-married respondents in the sample, as this variable is not available at the individual level for the non-married (within the married sample, the results do not change substantially between the community vs. individual-level variable). The variable is based on the following question, asked to married women: "Who usually makes decisions about health care for yourself: you OR your husband/partner OR you and your husband/partner jointly OR someone else?". Two variables are constructed: one is the average share of married women at the DHS sampling cluster level who say "husband decides alone". The other is the average share of married women at the DHS sampling cluster level who say "I decide alone". The "omitted" category is the average share of married women at the DHS sampling cluster level who say "husband and wife decide together". Less than 0.5% of the sample answered "someone else" or "other".

Table A3.1: Test of stochastic dominance on number of barriers faced, Somers' D.

	Somers' D	Jacknife Std. Error	95% confidence interval	
Secondary education vs. lower	-0.558***	0.028	-0.613	-0.502
Lowest two wealth quintiles vs. three highest wealth quintiles	0.786***	0.025	0.738	0.834
Urban vs. rural	-0.896***	0.020	-0.935	-0.857

Note: *** indicates a P-value<0.001, complete case sample analysis

Table A3.2: Association between barriers and facility delivery, logit coefficients.

facility delivery	no controls	with controls
Affordability barrier	-0.551*** (0.147)	-0.386*** (0.145)
Cognitive barrier	-0.754*** (0.145)	-0.642*** (0.151)
Psychosocial barrier	-0.404*** (0.112)	-0.298** (0.150)
Geographic barrier	-0.788*** (0.254)	-0.815*** (0.249)
Availability barrier	-0.527** (0.254)	-0.459* (0.259)
Quality of care barrier	-0.738*** (0.226)	-0.660*** (0.230)
Mean autonomy in community *(Ref: % wives who report join decision-making on healthcare)*		
% wives who report husband decides their healthcare		0.773* (0.397)
% wives who report they decide by themselves on own healthcare		0.217 (0.408)
Mother secondary education or higher		0.559*** (0.134)
Mother age at birth		-0.00332 (0.0119)
# Women of reproductive age in household		0.127 (0.119)
Mother married		0.192 (0.148)
Mother's occupation *(Ref: working in non-agric. job)*		
Mother not working		-0.407*** (0.151)
Mother agricultural occupation		-0.567*** (0.182)
Constant	3.037*** (0.183)	2.635*** (0.420)
Observations	2988	2988

Note: Complete case sample; robust clustered standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$

Table A3.3: Sample size by barrier and number of other barriers faced

		Number of other barriers					
		0	**1**	**2**	**3**	**4**	**5**
Affordability	0	279	759	314	152	137	72
Affordability	1	22	148	266	331	338	170
cognitive	0	279	68	82	75	64	
cognitive	1	713	380	343	404	410	
psychosocial	0		781	318	317	344	206
psychosocial	1		144	101	124	204	170
geographic	0			462	396	310	132
geographic	1			22	158	278	170
availability	0		781	432	276	81	
availability	1		30	142	387	410	
quality	0	279	735	240	38		
quality	1	46	222	380	468		

Note: Complete case sample

Chapter 4: Women who break the rules: Social exclusion and inequities in pregnancy and childbirth experiences in Zambia (Paper 3)

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Chapter 4: Women who break the rules: Social exclusion and inequities in pregnancy and childbirth experiences in Zambia (Paper 3)

Abstract

Health inequities are a growing concern in low- and middle-income countries, but reducing them requires a better understanding of underlying mechanisms. This study is based on 42 semi-structured interviews conducted in June 2018 with women who gave birth in the previous year, across rural and urban clinic sites in Mansa district, Zambia. Findings show that health facility rules regulating women's behaviour during pregnancy and childbirth create inequities in women's maternity experiences. The rules and their application can be understood as a form of social exclusion, discriminating against women with fewer financial and social resources. This study extends existing frameworks of social exclusion by demonstrating that the rules do not only originate in, but also reinforce, the structural processes that underpin inequitable social institutions. Legitimising the rules supports a moral order where women with fewer resources are constructed as "bad women", while efforts to follow the rules widen existing power differentials between socially excluded women and others. This study's findings have implications for the literature on reversed accountability and the unintended consequences of global and national safe motherhood targets, and for our understanding of disrespectful maternity care.

1. Introduction

The maternal health literature's excessive focus on individual-level barriers to maternal healthcare access may have fuelled individual-level approaches to addressing maternal health inequities (Gabrysch and Campbell, 2009; Moyer and Mustafa, 2013). Targeted behaviour change interventions, abolishing user fees, or conditional cash transfers have been rolled out to increase access to care among those shown to have least access: the uneducated, the poor, those who do not save, or older women (Målqvist et al., 2013). Other studies have taken a more systemic perspective, investigating whether some health facilities may simply be too far or too low quality for certain populations to access them (Gabrysch et al., 2011). This line of enquiry has yielded its own set of interventions, such as building more facilities, distributing transport vouchers or bicycle ambulances, or introducing performance-based financing. Yet despite the growing prioritisation of health equity, intra-country inequities in access to maternal healthcare services in Low- and Middle-Income Countries (LMICs) remain larger and are reducing at slower rates than inequities in other primary healthcare areas (Boerma et al., 2018). Given this comparative lack of progress, we need to better understand the underlying mechanisms producing inequities in order to inform policy (Friedman and Gostin, 2017; Krieger, 2001; Wainwright and Forbes, 2000). Understanding mechanisms may depend on including power processes in our analyses, a rare occurrence in the LMIC health policy and disrespectful maternity care literatures (Bradley et al., 2016; Sriram et al., 2018).

Also lacking is a broader understanding of maternal health inequities that includes the absence of "unfair and avoidable" differences in "mental and social well-being" (Ramírez, 2016; Whitehead, 1991, p. 219; WHO, 1946, p. 1). If we take this definition of *health* equity seriously, we cannot reduce it solely to equitable healthcare access, healthcare quality, or even respectful maternity care. According to Freedman et al's (2014) definition, disrespect and abuse of women in maternal healthcare includes "specific provider behaviours experienced or intended as disrespectful and humiliating" as well as " systemic deficiencies that create a disrespectful or abusive environment" (Freedman et al., 2014, p. 915). Disrespectful care's focus on the health worker-woman interaction necessarily omits exclusionary social interactions with other patients, as well as the internalised shame, guilt and suffering that socially excluded women feel when weighing the biomedical benefits of a facility delivery with the high material and social costs required to access it (Spangler, 2011;

Spangler and Bloom, 2010). Inequitable experiences of disrespectful care are currently understood, at best, as provider-instigated discrimination rooted in broader societal factors such as gender and economic inequities, but existing studies do not investigate whether the institutions of the health system and the health facility also propagate inequitable experiences (Betron et al., 2018; Bradley et al., 2016). Finally, the definition of disrespectful care focuses on what is consensually deemed to be disrespectful, ignoring any sanctions that women themselves understand as "deserved" in light of "deviating" behaviour.

Recent studies have described the phenomenon of fines being introduced in Sub-Saharan African countries, including in Zambia, to coerce women into giving birth in health facilities, often from the valuable lens of "reversed accountability" (de Kok, 2019; Greeson et al., 2016; Lodenstein et al., 2018; Melberg et al., 2016). One review has previously identified health facility rules as a driving factor of disrespectful care (Bradley et al., 2016). However, no studies of which I am aware investigate the relationship between rules, sanctions, and inequitable experiences in pregnancy and childbirth.

In order to explore the mechanisms behind inequitable pregnancy and childbirth experiences, this study uses diverse women's perspectives on their own recent experiences and a theoretical approach that explicitly acknowledges power, Naila Kabeer's (2000)social exclusion framework. Contrary to much of the existing literatures on maternal health inequities and on disrespectful care, which focus on women's characteristics or the health system's shortcomings, this study's findings illustrate that inequities can be created and reinforced by routine institutions: health facility rules governing how women should behave in pregnancy and childbirth. Adding to the literature on reversed accountability and the use of by-laws in maternal healthcare, this study is the first to describe a broad set of health facility rules from women's perspectives and to analyse how these rules create inequities in maternal healthcare.

1.1. Theory

This study draws on Naila Kabeer's framework of social exclusion (2000), applying it for the first time to the analysis of maternal health inequities. According to this framework, social exclusion or inclusion operates on the basis of different and overlapping forms of disadvantage attached to social groups. Disadvantage can be economic but also cultural or representational. Economic and cultural advantages translate to power, which groups can use, consciously or unconsciously, to further their existing advantages through strategies of inclusion or exclusion. This framework is well suited to the analysis of women's overall experiences of pregnancy and birth, and the inequities therein, by including representational disadvantage in its definition of injustice:

Disrespectful behaviour does not represent an injustice solely because it constrains the subjects in their freedom for action or does them harm. Rather, such behaviour is injurious because it impairs these persons in their positive understanding of self - an understanding acquired by inter-subjective means (Honneth, cited in Kabeer 2000, 84).

The framework also draws attention to how institutions (such as health facilities) operate as potential agents of exclusion. Institutions are posited to govern the distribution of resources (such as access to high quality and respectful maternal healthcare), according to rules that may or may not privilege existing endowments or group belonging. The institutions and the rules do not themselves cause social exclusion. Social interactions and power relations between groups result in the creation of institutions that have the potential to exclude.

Kabeer identifies a range of practices through which groups can use institutions to exclude, in conscious or unconscious ways. Two of them are relevant here. Firstly, 'mobilisation of institutional bias' (Lukes, 1974), defined by Bachrach and Baratz as "a predominant set of values, beliefs, rituals

and institutional procedures ('rules of the game') that operate systematically and consistently to the benefit of certain persons and groups at the expense of others." (Kabeer, 2000, p. 91). For example, institutional procedures such as health facility rules, which apply theoretically to everyone, may have inequitable effects as a result of being easier to comply with for some social groups than others. Secondly, 'unruly practices' (Fraser, 1989; Gore, 1993), which refer "to the gap between rules and their implementation, which occurs in practice in all institutional domains" (Kabeer, 2000, p. 92). In the context of this study, rules could be enforced in a discriminatory fashion, with privileged groups being allowed to flout the rules without sanction.

This study also refers to the concept of "authoritative knowledge" in order to explain how the "rules of the game", and the sanctions for not following these rules, are legitimised. Initially developed by Brigitte Jordan (1997) in her cross-cultural studies of childbirth, authoritative knowledge refers to the knowledge that "counts" in a specific space, and on the basis of which decisions are made. Authoritative knowledge both reflects and strengthens existing power dynamics. In hierarchical settings, even those who are disempowered by the prevailing form of authoritative knowledge participate in legitimising it. Part of the process of establishing a single form of knowledge as authoritative is to devalue other forms of knowing and to label those who "still align themselves with the non-authoritative knowledge […] "as backwards, ignorant, and naïve, or worse, simply as troublemakers"" (Jordan, 1997, p. 56).

1.2. Context

Zambia has a fertility rate of 5.3 and a maternal mortality ratio of 232 deaths per 100,000 live births (Central Statistical Office (CSO) [Zambia] et al., 2014; WHO et al., 2019). While the latest measure of the proportion of women who delivered in a health facility was 64.2% (2008-2014) (CSO et al 2014), rates have likely increased in the interim. Inequities in access to facility delivery have been decreasing since 2002, albeit at a slower rate than inequities in access to child healthcare (Assaf and Pullum, 2016). The absolute difference between facility delivery rates in the richest vs. poorest wealth quintiles was almost 50 percentage points over the 2008-2013 period (CSO et al 2014). The Government of Zambia has made it a priority to reduce these inequities in its National Health Strategic Plans (Republic of Zambia Ministry of Health, 2017, 2011, 2005). Many health and health-related reforms have been initiated in Zambia over the past ten years with inequity reduction in mind.

This study draws on data collected in Mansa district, Luapula Province, which was purposively selected because it has one of the lowest averages for facility delivery in the country according to the last available Annual Health Statistical Bulletin of 2013 (39%). Mansa district hosts the capital of Luapula Province and was selected due to high levels of contrast between its urban and rural areas, both in terms of distance to well-equipped health facilities and type of livelihood. Rural residents mostly make a living from subsistence or small-scale farming as well as farming others' fields or selling goods such as home-brewed beer. Urban residents typically either have informal jobs such as roadside sellers, or service industry jobs such as bank clerks, police-women, and teachers. Mansa district has 56 facilities (of which 1 hospital and 6 urban health centres) and 4 ambulances for approximately 258,800 people (Worldpop, 2016). There were only two consultant obstetricians at the time of fieldwork in June 2018, both based in the provincial hospital in Mansa town. There are no doctors in health centres, where deliveries should be conducted by nurses (who may or may not have midwifery training) or clinical officers.

2. Methods

This study focuses on women's perspectives. Many other constituencies, such as women's husbands or families (Kaiser et al., 2019a), health workers, health administrators, and policy-makers

are highly relevant for explaining women's inequitable experiences of pregnancy and childbirth. However, because the paper is grounded in a thick description of inequities as experienced by pregnant and labouring women, data collection focused on women with diverse and overlapping characteristics instead of comparing women's reports to that of their husbands, families or health workers.

The study is based on analyses of 42 semi-structured interviews with women aged 18 or older who had given birth in the previous 12 months. Interviews were conducted in June 2018 and collected information on women's experiences of their most recent pregnancy and birth, as well as their views on which types of women were more likely to have negative or positive experiences. I also took notes during (but did not audio-record) informal conversations with health workers, health volunteers, and two district health officers.

The interview guide was initially drafted by the author and adapted in a pre-data collection workshop with the interviewers, according to their understanding of the field site's context. It was progressively modified during data collection in order to further explore themes raised by respondents (such as home delivery, fines, finding money for the birth, etc.), based on daily discussions between the interviewers and myself[18]. The interviews were conducted in the Bemba language by two interviewers from Lusaka whom I trained and supervised, with some respondents choosing to be interviewed in English. I was always present at the data collection site, and present in 4/42 interviews. Interviews lasted between 35 and 60 minutes and took place in an aurally private location, often outside and always within the perimeter of the immunisation clinic.

Respondents were recruited from nine child immunisation clinics (including outreach clinics) in rural and urban settings. Recruitment combined convenience and purposive sampling to compare women's experiences from diverse and overlapping social locations (Table 1). Respondents were assigned characteristics by self-reporting, except for the "visibly poor" category, which was determined by the interviewers and myself, using their interview notes about the respondent's attire and appearance. The intention was to capture visual clues indicating poverty relative to the study's context (e.g.: poor quality of chitenge cloth typically used as clothing, torn shoes, un-groomed hair), as opposed to my or the interviewers' relative wealth. While this categorisation cannot measure actual poverty, these markers could have sparked processes of social exclusion. Written or oral informed consent was obtained for all interviews. During the consent process, interviewers stressed that they were not working with the health facility but that the health workers and the Ministry of Health were aware of our presence. Ethical clearance for this study was obtained from the London School of Economics Ethics Committee [ref. 000576] and the University of Zambia Biomedical Research Ethics Committee [ref. 005-06-17].

[18] The English-language version of the interview guide, as well as information sheet and consent form, is provided in Thesis Appendix 3.

Table 1: Sample characteristics

Category	Sub-category	% (n = 42)
Age	18 to 20	17%
	21 to 35	60%
	Above 35	21%
	Not collected	2%
Education	No education	2%
	Some primary education	40%
	Some secondary education	41%
	Some higher education	10%
	Not collected	7%
Marital status	Single, widowed or divorced	26%
	Married to father of child after conception	7%
	Married to father of child prior to conception	67%
Work	Farmer	43%
	Other informal work	10%
	Formal work	7%
	No work outside the home	40%
Parity	1st birth	29%
	2nd to 5th birth	48%
	6th or more birth	24%
Residence	Rural	50%
	Urban	50%
Visibly poor	Not visibly poor	64%
	Visibly poor	36%
Place of delivery	Delivered at home or en-route to facility	10%
	Facility delivery	90%

All interviews were audio-recorded and were transcribed from the Bemba audio recording into English by the interviewers and two additional research assistants. Names of people and places were redacted in the quotes used in this paper and the respondents themselves are referred to with codes. Common Bemba expressions have not been translated from English – these include “Awe” (“no”/“nothing” or used as an exclamation); “Emukwai” (an expression of agreement or positive emphasis); “Kaili” (“because” or for negative emphasis); “Ba” Sarah (respectful manner of referring to Sarah). Costs are given in Kwacha, the Zambian currency. In June 2018, 10 Kwacha was equivalent to 1 USD.

I analysed the interview data using a simplified grounded theory approach adapted from Corbin and Strauss (2012). Specifically, some codes emerged from the transcripts, while others were informed by the interview guide (which did not pre-suppose any mechanism for explaining inequities). In line with grounded theory, I drafted memos to summarise the content of one or more codes, ask additional questions of the data, and look for differences in coded content between categories, e.g. “married” vs. “not married”. I also explored analytical relationships between memos during the

writing process. Unlike a pure grounded theory approach, memos were not drafted for all codes but only for those relevant to a salient mechanism that emerged during the coding process, and which is explored in-depth in this paper. The theoretical perspectives used in this paper did not emerge from this study but neither were they anticipated prior to memo-writing; rather, they were applied during the write-up phase in order to understand the implications of the findings.

3. Findings

This study found that health facility rules form an important part of participants' experience of pregnancy and childbirth and have inequitable effects. Women with fewer social and financial resources are less able to follow the rules and are therefore more at risk of being subjected to sanctions, or more likely to make significant sacrifices to follow the rules. The authoritative knowledge legitimising the rules also strengthens the view that women with fewer resources are 'bad women', while women's efforts to follow the rules and avoid sanctions reinforces inequitable power relations within and beyond the health facility.

In section 3.1, I describe the health facility rules, as well as the sanctions women were subject to if they broke the rules. I then explain how the rules can be understood as social exclusion processes resulting in inequitable experiences of pregnancy and childbirth in section 3.2. In section 3.3, I explain how the rules reinforce inequitable structural processes through their influence on the moral order and power relations.

3.1. Rules and sanctions

In this section, I explain how I identified the "rules", the scope and nature of this study's evidence on rules, and what the rules and sanctions are. I categorised guidelines for behaviour in pregnancy and childbirth as "health facility rules" according to respondents' reports. In order to count as a rule, respondents needed to say that this behaviour guideline had been communicated by health workers or the health facility. It was not necessary for respondents to: mention any specific sanctions linked to the rule; actively label it as a rule, a law or an order; or for the rule to be mandated by the health system or a traditional authority. Rules mentioned frequently towards the beginning of the data collection process were specifically asked about in subsequent iterations of the interview guide, thereby increasing the likelihood of reporting. The list of rules should not be understood as exhaustive or representative, but as evidence that a set of rules is highly relevant to women's pregnancy and birth experiences in Mansa and, very likely, beyond (see Discussion).

Table 2: Health facility rules

Category	Rule	n respondents
Resources rules	Bringing materials to the facility when giving birth, e.g.: soap, Jik, dish/tub/bucket, plastic sheet, gloves, nappies, chitenges, clothes for the mother, clothes for the baby	15
	Taking a car or taxi to leave the facility after birth	2
Sexual and reproductive rules	Not having extramarital sexual relations	3
	Not having 'too many' children	2
	Should have sex with the husband during pregnancy	1
Maternal healthcare seeking rules	Giving birth at the facility	16
	Bringing the father of the baby when registering the pregnancy	11
	Not using traditional medicine "for opening the way" in pregnancy or childbirth, which is a mixture of herbs to hasten delivery	7
	Going to the mother's waiting shelter in the last month of pregnancy	4
	Attending ANC	3
	Starting ANC at 2 or 3 months	3
	Coming to the facility promptly when in labour	2
	Taking facility medicine during pregnancy	2
	Coming to the facility for delivery with the "SMAG" (community health worker)	1
Rules during labour at the facility	"Being strong", i.e.: not making noise or crying, and successfully pushing the baby out	6
	Being clean and shaving pubic hair prior to arrival for delivery	6
	Lying down during labour and not moving around the delivery ward	4
	Women's entourage not allowed in the labour ward	3
	Using a bucket instead of the toilet for urine and faeces	3
	Obeying instructions from healthcare workers	3
Lifestyle rules during pregnancy	Not doing heavy work	6
	Staying active	5
	Eating well and observing dietary recommendations or restrictions	5
	"Keeping well", i.e.: providing for and looking after yourself, your loved ones and your home	4
	Clothing restrictions, i.e. wearing a maternity dress, not wearing tight clothes	1

Respondents mentioned 25 different rules (Table 2 & Appendix 4 for quotes). The rules can be categorised into five different groups: rules directly linked to resources; sexual and reproductive rules; rules around healthcare seeking for pregnancy and childbirth; rules during labour at the health facility; and other lifestyle rules. Respondents' language around rules included words translated as "must"; "should"; "told"; "have to"; "not allowed"; "not supposed to"; "required"; and "taught". The level of coerciveness implied by respondents' language varied from strong norms to laws (i.e. traditional authorities' by-laws), depending on the respondent but mostly on the rule itself and associated sanctions, if any.

Many of these rules were mentioned by less than five respondents, but three rules were mentioned by 10 or more different respondents: giving birth at the health facility; bringing in-kind materials to the health facility when giving birth; and bringing the father of the baby to the facility to register the pregnancy. Most rules were mentioned across sites, with no specific rural-urban pattern, or whether women had delivered in a health centre or the hospital. The exception is the rule about

not having extramarital sexual relations, which was only mentioned by 3 out of 6 respondents from one specific site.

Many respondents described specific sanctions which they had experienced or which they expected to incur if they broke the rules. Fines up to K50 were charged for delivering from home, or up to K10 for registering the pregnancy late or not at all. These fines were confirmed in informal conversations with community health workers ("SMAGs") from two sites and with two district health officers.

Women coming without the father of the pregnancy to register at the health facility could be excluded from antenatal registration, unless they received special dispensation from the SMAG or the chief. One urban woman of low socio-economic status who had recently been left by her husband said she was twice turned away from registering her pregnancy due to not having a husband.

Respondents also mentioned the possibility (or the experience of) being shouted at or scolded, being beaten or slapped, or being shamed by health workers if they broke the rules. For example, a respondent reported a situation during an antenatal clinic where women coming without husbands were shamed by being made to sit separately, leading to an altercation with the health workers, who accused them of sexual promiscuity ("*meeting in the grass*").

> *"They said, 'Those with husbands should sit as a couple', us, we sat [with] those who had husbands. Those without husbands sat on their own. Those without husbands, were 4… […] So, they [health workers] said, 'We will only register those with husbands, if you were meeting in the grass, you should go, if they [husbands] were trees, you should go and call the same trees and register with them'." [03-09-01]*

Health workers might also make women feel responsible for negative health outcomes when they did not follow the rules**.** In the quote below, the health worker tells the respondent that she has caused her own illness as a result of not following the rule about doing only light chores during pregnancy:

> *"I got sick, I even went back to the clinic, at the clinic they asked me that, "were you doing any work when you were pregnant?" "Emukwai I was working," "But we don't allow you that's what has caused you to get sick. Medicine, I will not give you any medicine, that is work paining, it has brought you sickness. We refuse [don't allow] you [to work] when you are pregnant." [04-09-01]*

Sanctions were not the only, or perhaps even the main reason women followed the rules. Both the rules and the sanctions were legitimised by authoritative knowledge, to which health workers had privileged access. Women believed following the rules was the best way to manage the risky event of childbirth. This was partly because they saw the rules as inherently important for their health and their baby, and because following the rules enabled access to health workers with the "right" knowledge as well as drugs and equipment.

As is common in other settings, authoritative knowledge was constructed by framing information exchanges during antenatal care as knowledgeable health workers teaching ignorant pregnant women (Browner and Press, 1996; Jordan, 1997; Sesia, 2004):

> *"Because it was the first time, I have never had a child so. Like school they must teach me how giving birth is, they shouldn't anger because I don't know. Maybe I can kill the child because I don't know." [04-07-01]*

Simultaneously, the rules themselves reinforced authoritative knowledge by outlawing reliance on competing forms of knowledge. For example, women were not allowed to take traditional medicine

during pregnancy or labour, or to rely on their own judgement of how far along their labour was when deciding when to come to the health facility for birth.

3.2. Inequitable effects of rules

While respondents typically presented the rules as legitimate, the rules resulted in inequitable pregnancy and birth experiences. This is because not all women had access to the financial and social resources needed to meet the rules, and because the rules were unevenly applied. Inequities in the experience of pregnancy and childbirth were structured according to socio-economic status, rural vs. urban residence, marital status, age, number of children, and how much support could be expected from one's husband/father of the child or relatives. Respondents' overall vulnerability resulted from the intersection of these characteristics, with extensive links between financial and social resources.

3.2.1. Mobilisation of institutional bias

Women with insufficient resources could either break the rules, believing they were endangering their and their baby's health and risking sanctions, or follow the rules by making costly financial and relational sacrifices. In line with Kabeer's framework (2000), the rules can be understood as a form of institutional bias. While the exclusion is unconscious, the rules are designed to serve an "ideal" patient, excluding women who do not conform to that ideal.

Respondents with limited financial resources described making sacrifices to raise the required funds. One urban respondent in her 20s with two children did piecework in order to survive, often in exchange for food, and did not make enough to "*keep money*" (save). In order to pay for transport to the health facility (around 20K, equivalent to payment for weeding a field), she took out a loan from the woman she sells fritters for, who deducted it from her future earnings. She also accepted in-kind help in the form of baby clothes and nappies from the sister of her baby's father, even though he denied responsibility for the pregnancy. Despite these financial and relational sacrifices, she knew she would not be able to pass as a financially comfortable married woman when she reached the facility: *"Awe there is nothing you can feel [when you reach the facility] because you can steal [in order to look like the married women] so there is nothing you can feel, you just look at them"* [03-07-02]. She chose to make these sacrifices and face potential shame because she was worried about childbirth complications and being made to pay a fine she could not afford for home delivery.

For rural women, gathering sufficient financial resources to follow the rules could require sacrifices taxing their physical resources. A rural married woman in her 20s explained she had to shoulder a heavy workload during her pregnancy in order to store enough food for the post-partum period, which was also, ironically, against the rules:

> *"I hated work, I just used to work because when I give birth I would stay a lot of days [not working] … eating in this village it is food from the bush [so no work means no food]." [04-09-01]*

Other facility rules required women to be embedded within specific social relationships. Eleven respondents were unmarried or separated at the time of pregnancy and birth, which made it more difficult to follow the rule about bringing the father of the baby to register the pregnancy. While it is feasible for the father to fulfil this duty even if he is not married to the mother, unmarried fathers refused responsibility in 3 out of 11 of these cases.

The rule about doing only light chores when pregnant also assumes women can draw on social relationships. Being single would make it harder to follow this rule:

> *"I – How can someone being unmarried cause them to have a bad pregnancy or experience difficulties?*

R – Maybe she was doing difficult chores, others the pregnancy gets destroyed. […] Because she wouldn't have anyone to help her." [04-02-02]

Women's access to financial resources depended heavily on their social network, particularly their parents if they were unmarried or their husband if they were married.

3.2.2. Unruly practices

The ways in which the rules were applied varied according to women's characteristics. One rural respondent said women "*with names*" (important women), are not punished for delivering at home. An urban respondent of a higher socio-economic status who delivered from home due to a fast labour did not report paying a fine, although health workers *"were not happy because I gave birth at home so they had to say a lot 'why didn't you come, you knew that you were in labour…' then I had to explain what happened."* [03-03-01]. Another urban woman, who was educated but poorer, delivered from home due to her husband not being there at the start of labour, and did not mention incurring a fine either. She was delivered by her neighbour, a retired nurse who after delivery went with her and the baby to the facility to explain the situation. The advocacy of the retired health worker likely helped her to avoid a fine or a confrontation with the health workers.

Sanctions also depended on socially constructed expectations about women's level of responsibility and vulnerability. For example, young women were thought to be less able to give birth. As a result, health workers were perceived to be more patient with them during labour. While this flexibility in the application of the rules appears to address underlying inequities, it might impair *"a positive understanding of self"* (Honneth, cited in Kabeer 2000, 84) for young women giving birth. This respondent aged 17 at the time of the birth explains:

"Yes I was doubting 'how am I going to deliver', since I was young according to the years I had but they say that if you are 20 years you don't suffer when delivering. I was too young so I doubted on 'how I was going to deliver, are they going to operate me or I will deliver, what will happen'"[03-05-01]

Several respondents mentioned health workers felt married women should be held to a higher standard in terms of financial preparations for childbirth, because of their presumed greater access to social and financial resources:

"…if you are married they get upset that, '9 months [how] can you fail to prepare for the child [or] even things to leave with?'" [04-09-01]

This ignores the situation of several respondents who said their husbands cannot or will not provide support, despite the gendered norms prescribing that they should. While other respondents said the husbands would be sanctioned as a result, the final responsibility was often constructed as the wife's:

"They [health workers] get upset. They get upset, from the time you get pregnant until you give birth, can you lack even one coin, can't you surely keep that same coin if you see that my man is not serious with what he is doing." [04-10-02]

3.2.3. Rules as social exclusion?

In order for the rules to be understood as a strategy of social exclusion, it is important to show that they originate in unequal power structures. While underlying power structures were not investigated by this study, it is suggestive that women with fewer financial and social resources faced discrimination beyond the health facility as well. For example, women reported being excluded from community groups organised through the church, either as a result of having a non-marital pregnancy or because they lacked financial resources:

> *"Now, kaili the meetings at Dorcas they see how a person is, that is when they pay attention to her. If we compare [look at] these churches we have, if you do not have anything to give, they do not consider that person." [03-10-03]*

As well as universally dropping out of school, young unmarried women frequently reported suffering from being gossiped about and socially excluded because of their pregnancy:

> *"People talk when you get pregnant, people talk anywhere you pass […]. Yourself you know that yes I am pregnant then you start thinking that it's better I kill myself. You feel ashamed [in front] of people, and then you stop moving about [going out] and stay home." [04-05-02]*

Unmarried pregnant women were also likely to experience sanctions from their relatives. Relatives' reactions to their pregnancy included shouting and scolding, chasing their daughter from the house, not speaking to her, and denying her financial support.

These social sanctions were underpinned by a moralised discourse of personal responsibility. Respondents who did not identify themselves as lacking resources emphasised women could always save some money, e.g. from braiding hair, or could ask friends for help, perhaps in exchange for some work. They perceived women lacking financial resources in pregnancy as lazy or irresponsible. Unmarried pregnant women were described as being sinful, stupid, or too proud.

3.3. Structural effects of rules

Health facility rules not only exclude women with insufficient financial and social resources, but also reinforce the structural processes that underpin inequitable social institutions such as the rules themselves. The moralised discourse around rules provides an additional rationale for community members to label women with insufficient financial and social resources as "bad women", while the imperative to follow the rules puts pressure on socially excluded women to further disempower themselves, thereby widening existing power differentials.

3.3.1. Reinforcing the moral order

Women who struggled to follow facility rules were often constructed as bad women by other respondents, specifically *as a result* of them breaking the rules. From the perspective of authoritative knowledge, this is not surprising, as those who do not align themselves with authoritative knowledge are frequently constructed as immoral (Jordan, 1997, p. 56). The fact that women police other women's compliance with health facility rules suggests that authoritative knowledge potentially reinforces the inequitable moral order beyond the health facility by providing a separate rationale for holding women with fewer resources morally responsible. This is demonstrated by the rule banning home deliveries.

When asked why women delivered from home, or what people said about those who delivered from home, many respondents who had delivered in a health facility made strong moral judgements about those who stayed at home, although some also mentioned practical constraints (money, distance). Women who delivered at home were deemed: stupid, backwards, or ignorant: *"maybe the one that is [gives birth at] home has never been to school, they have never learnt"* [04-07-01]; disrespectful towards the government or the health workers: "*if I delivered from home and the facility is there, it means I have disrespected the health workers, like there is nothing they can do*."[03-07-01]; careless: "*these people who deliver from home don't care for themselves*" [03-05-02]; or lazy: "*They say that they are lazy because someone can't say that they didn't know, when labour has started, someone knows that here labour has started*" [04-04-02].

3.3.2. Reinforcing inequitable power relations

Facility rules reinforced inequitable power relations between women and others in their social worlds, such as the fathers of their baby, their relatives, but also with regards to health workers and traditional leaders. Unmarried women have less access to the financial and social resources required to meet the rules. In this way, the rules contribute to reinforcing the importance of being married while pregnant, even when marriage is disempowering for the pregnant woman. This 19 year-old living in a rural area was deeply unhappy that her pregnancy and marriage ended her schooling, dashing her hopes of becoming financially independent:

> *"(laughs) Nurse [referring to the interviewer], can you be okay in this village we live in and at the age I got pregnant? I can't work for the government or in my marriage. That is not okay because I can't get paid my own money. Even if I was to work for the government, there is nothing I can do because I stopped school. […] at this age I was supposed to be in school and not married." [04-05-02]*

The rule about bringing the father to register the pregnancy reinforces inequitable power relations between men and women by making women dependent on men's willingness to assume paternity.

The rules also reinforce inequitable power relations between unmarried mothers and their relatives. Unmarried mothers had to face severe social sanctions and perform their guilt in order to reconcile with their families, upon which they relied to meet facility rules:

> *"Even if they talk, I just accept that I wronged them. A mistake is made once, the way I have made a mistake I will not do it the second time." [04-07-02]*

> *"At last I asked for forgiveness that what I did I wronged, they listened and forgave me." [03-05-02]*

Finally, the rules reinforced inequitable power relations between women and authority figures such as health workers and traditional leaders, who had the power to wave sanctions conditional on women performing their vulnerability. The process of receiving an exemption requires women to reveal personal circumstances that are socially constructed as shameful to people in authority. For example, a respondent reported coming to the facility with no transport money or materials for giving birth as a result of having been left by her husband in pregnancy. Rather than emphasising her entitlement to respectful care, she said the nurses helped her out of "pity" and because they happened to have "good hearts". It was also necessary for the respondent to reveal her circumstances in order to receive assistance:

> *"I saw the nurse, okay I saw the nurse was not happy comparing [with regards] to what I explained, the nurse felt pity, even if she [nurse] accepted it, it was because it is God's power. [She is one of] those who have good hearts." [03-10-03]*

4. Limitations

The following aspects of the research design may have led respondents to more actively legitimise rules and sanctions, and to avoid mentioning their own "transgressions" and the sanctions they experienced as a result: interviews were held within the health facility compound or outreach location; interviewers often had a higher social status than interviewees with respect to their education, fluency in spoken English, material wealth signalled in terms of clothing, and having a formal, white-collar job;

some respondents believed the interviewers were health workers and I was a Peace Corps volunteer, a position of potential authority (despite the information and consent process stating the contrary)[19].

The recruitment strategy de facto excluded women whose experiences resulted in the loss of their baby or their life. The study also excluded women younger than 18 years, despite adolescent pregnancy being relatively common in Zambia (CSO et al 2014), for practical reasons linked to getting parental consent. While the experiences of the <18 age group should be explored in future research, most of the respondents aged 18-20 years old self-identified as being "too young" to give birth. Interviewees were assigned the "visibly poor" category at the time of the interview, which may have differed from their appearance at the time of the birth. Furthermore, it is not known whether health workers or people in the community use the same visual cues as the interviewers to determine whether someone lacks financial resources. The "visibly poor" category was used along with many other categories to inform small-n purposive sample selection, and for the initial structuring of analytical comparisons. I identified respondents as "lacking financial resources" in the final analysis solely according to their own accounts.

While I attempted to interview both women who had and had not delivered at a health facility, only 4 out of 42 respondents did not deliver in a health facility. This may be due to respondents being unwilling to reveal a home birth, women delivering at home being unwilling to speak with us, or to a genuinely low level of home deliveries in Mansa in 2018, a statistic that is not compiled by the district health office. This was not a function of recruiting respondents from immunisation clinics, since only 2.3% of children aged 12-23 months have never received a vaccination (CSO et al 2014). Rather, it could be a consequence of home delivery being against the rules and thus stigmatised, combined with our team's perceived connection to authority. This limitation raises questions about the extent to which the rules influence the maternity experiences of all women, as this study claims, regardless of healthcare access. Given that traditional leaders implemented by-laws mandating maternal healthcare access, that health facility rules are socially policed, and that social control is extensive (Phiri and Moland, 2014; White and Jha, 2018), the experience of pregnant women who eluded contact with the health system is very likely to have been structured by health facility rules.

5. Discussion

While this study did not set out to gather evidence on how the rules affected maternal healthcare access and outcomes, district health officers believed the rules helped to avoid home deliveries and led to fewer maternal deaths. However, this study's findings imply that what works to meet average health targets may not work to reverse health inequities. This is particularly true when health inequities are understood to include wellbeing.

Kabeer's (2000) framework highlights that inequitable power relations are the root cause of social exclusion. While this study did not investigate these power relations in depth, examination of the sociological literature on Zambia suggests that at least three types of power relations are worthy of further investigation in this context: between genders, between the poor and the rich, and between formerly colonized and (neo-)colonial states. These domains are all highly relevant to people's lived experience in Zambia, are in flux, and mutually affect each other (Cole et al., 2015; Evans, 2014b, 2014a; Phiri and Abebe, 2016). This study also suggests possible extensions to Kabeer's analytical framework by showing that health facility rules are not only shaped by social processes, but actively influence these social processes as well. For instance, the pressure to follow the rules or seek exemptions may force women lacking resources to accept a further diminished position in society, also noted in the context of maternal health rules in Malawi (Lodenstein et al., 2018). Similarly, the

[19] Positionality and ethical complexities are more thoroughly reflected upon in Chapter 6 of this thesis.

fact that women who do not follow the rules are constructed as bad women reinforces socially excluded women's perceived immorality outside of the health facility. The role of a moralised health discourse as an engine of social exclusion has recently been documented in other contexts, such as healthy eating in US adolescents (Fielding-Singh, 2019) and the use of social sanctions to encourage hygienic behaviours in a range of settings (Brewis et al., 2019).

This study focussed on women's perceptions of the rules, as well as the actual and expected consequences of these rules for women. Generating evidence on the origin, formulation and application of the rules would require analysis of policy-making and enactment at various levels. In terms of the origin of rules, it is important to note that the rules are not necessarily evidence-based. For example, the rule about "lying down" during delivery has a long history in former colonial powers (e.g.: Oakley 1984) but is not be supported by available evidence (Gupta et al., 2017). There also appears to be contradictions between official policies at the national-level, and the rules implemented at the facility level. There is no national policy on fining mothers who deliver at home or requiring them to bring specific items for delivery, and Ministry-level officials have condemned these practices in the past (Greeson et al., 2016). There are national directives encouraging male involvement in maternal and child health, but no official sanctions to incentivise this. However, other Zambian studies document the requirement of bringing materials for a health facility delivery (Mulenga et al., 2018; Sialubanje et al., 2014a), fines for home delivery (Chibuye et al., 2018; Greeson et al., 2016; Kureya et al., 2016; Phiri and Moland, 2014), and other rules (Appendix 4). Two district health officers in Mansa said they were aware of the fines, and that the district health office works in partnership with traditional leaders, who implemented the by-laws.

The "reversed accountability" literature might help illuminate these apparent contradictions. Health workers, district officials, and traditional authorities are being held accountable for home deliveries and maternal deaths by provincial and national governments, which are themselves under international pressure to achieve quantitative safe motherhood objectives (Austveg, 2011; Storeng and Béhague, 2014). This is well documented by Evans' (2018a) ethnographic study of the prioritisation of maternal health indicators within the Zambian health system. Health workers may also face additional material and reputational incentives to achieve quantitative objectives relating to maternal healthcare since results-based financing (RBF) in Mansa district began in 2017, as part of a broader programme and in line with global health policy trends. However, it is interesting to note that health facilities in Mansa collect but do not report the number of home births to the district level. Other studies link these accountability pressures to health facility sanctions directly, covering diverse contexts such as Burkina Faso, Nicaragua, Malawi's Presidential Initiative for Maternal Health and Safe Motherhood, Tanzania's locally funded performance-based financing programme, and Zambia's Saving Mothers Giving Life project (Chimhutu et al., 2014; de Kok, 2019; Greeson et al., 2016; Kvernflaten, 2013; Lodenstein et al., 2018; Melberg et al., 2016). While there is variation in whether higher levels of governance condemn the use of rules and sanctions to achieve safe motherhood objectives, there seems to be cross-country similarities in the accountability contract. Specifically, lower levels are given the freedom to choose strategies best suited to meet the objective, but typically only insufficient (or no additional) resources to achieve the objective. This is reminiscent of Walker and Gilson's (2004) analysis of nurses as street-level bureaucrats, i.e. workers who enact public policy in the form of routinized practices, in a context that combines discretion over how to accomplish tasks with insufficient resources (Lipsky, 1980; Reckwitz, 2003).

This study's findings also have implications for how we understand disrespectful maternity care. The majority of respondents in this study understood sanctions as deserved punishment for breaking the rules, and only rarely mentioned nurses' personalities or moods as driving factors. Findings also highlight the important role of "institutional bias", which, contrary to "unruly practices", emphasises

the inequitable potential of "the rules of the game" themselves, as opposed to their discriminatory or deficient application. In contrast, the current global framing of disrespectful care only includes health system deficiencies and instances of provider behaviours that are identified as disrespectful by victims and others. While Freedman et al (2014) convincingly argue that an initially restricted focus on these aspects of disrespectful care will facilitate progress, we should evaluate whether such a focus is able to address inequitable experiences of disrespectful care.

6. Conclusion

Health facility rules regulating women's behaviour in pregnancy and childbirth result in inequitable pregnancy and birth experiences in Zambia. Women with fewer social and financial resources struggle to meet the rules and must either suffer sanctions if they are unable to follow them, or make costly sacrifices in order to comply. The rules also strengthen social exclusion processes beyond the facility by reinforcing inequitable power relations and a moral order where a lack of financial and social resources is believed to result from personal shortcomings.

These findings highlight inequities in women's experience and identify an important mechanism behind maternal health inequities. Policy-makers should develop responses that actively seek to interrupt cycles of social exclusion.

Appendix 4: Detailed description of rules

Rule category	Rule	n respondents	Illustrative quote	Punishments mentioned by respondents	Other Zambian studies referencing this rule
Resources rules	Bringing materials to the facility when giving birth, e.g.: soap, jik, dish/tub/bucket, plastic sheet, gloves, nappies, chitenges, clothes for the mother, clothes for the baby	15	I. What about the health workers, what were they saying? R. What they were saying. The teachings and telling us what to take when going to give birth. You get a bucket, clothes for the baby, 6 chitenges, paper plastic and jik [03-10-01]	Disrespectful treatment, e.g. shaming, shouting, scolding, beating	(Chibuye et al., 2018; Kaiser et al., 2019a; MacKeith et al., 2003; Mulenga et al., 2018; Phiri and Moland, 2014; Scott et al., 2018; Sialubanje et al., 2014a, 2015; Stekelenburg et al., 2004)
	Taking a car or taxi to leave the facility after birth	2	He found the car because to discharge a person, they (nurses) required a car. [03-09-01]	None specifically mentioned	(Mulenga et al., 2018)
Sexual and reproductive rules	Not having extramarital sexual relations	3	R – I know just that ~ you must keep yourself not making marriage in the house. I – But how did you know that that is the way it is supposed to be? R – They teach us at the hospital." [04-10-03]	None specifically mentioned	
	Not having 'too many' children	2	They can't talk, because the children she is having when they are older, and the amount [max. number of children] they give at the health facility, has not yet [been] reached. [04-05-01]	None specifically mentioned	
	Having sex with the husband during pregnancy	1	They were telling us that you are supposed not to refuse to have sex with your husband because you are pregnant. [04-04-02]	None specifically mentioned	
Maternal healthcare seeking rules	Giving birth at the facility	16	The law, I know the way the law is, they don't allow giving birth in the village. All these 3 children I have had, I gave birth from the clinic [04-09-01]	Fines - Amount: K50 - K20	(Chibuye et al., 2018; Greeson et al., 2016; Kureya et al., 2016; Phiri and Moland, 2014)
	Bringing the father of the baby when	11	That is what they say: "go together, when a person is pregnant [they] should go with the husband to register the pregnancy" [03-10-02]	Not allowed to register the pregnancy, unless one has an exemption (from a	(Sialubanje et al., 2014a)

Rule category	Rule	n respondents	Illustrative quote	Punishments mentioned by respondents	Other Zambian studies referencing this rule
	registering the pregnancy			nurse, SMAG or chief) & Disrespectful treatment, e.g.: shaming	
	Not using the traditional medicine "for opening the way" in pregnancy or childbirth, which is a mixture of herbs to hasten delivery	7	At the hospital they don't allow, I have never heard that they allow to use African medicine no. [04-10-03]	None specifically mentioned	(Mulenga et al., 2018; Phiri and Moland, 2014)
	Going to the mother's waiting shelter in the last month of pregnancy	4	When I was 8 months pregnant, ba SMAG, ba nurse and the doctor came home and said you shift and go to the mother's shelter [03-02-02]	None specifically mentioned	(Chibuye et al., 2018)
	Attending ANC	3	It's been put as law for anyone who is pregnant and after to come for antenatal to know how the child is in the stomach and how it's moving [04-03-02]	Fines - Amount: K10 - K5	
	Starting ANC at 2 or 3 months	3	R – They say you must come when the pregnancy is 3 months, if you do not come at three months then you have to pay money [04-02-01]	Fines - Amount: K10 - K5 & Disrespectful treatment, e.g.: shouting	
	Coming to the facility promptly when in labour	2	They told us, they were teaching us that~ aahh signs of pregnancy that when pregnant when you notice it has become like this, you should do this. [...] So, they told us that when you notice your stomach starts paining in that situation, you must go to the nearest clinic or the hospital." [04-08-02]	None specifically mentioned	
	Taking facility medicine during pregnancy	2	R. They were helping by encouraging us to eat and said you should be drinking the medicine, folic acid because if you are not taking those, you cannot be having appetite. [03-02-02]	None specifically mentioned	
	Coming to the facility for delivery with the SMAG	1	We knew because they taught us at the clinic. When we used to come for antenatal that when coming here after you feel stomach pains, you have to ask	None specifically mentioned	(Kaiser et al., 2019a)

Rule category	Rule	n respondents	Illustrative quote	Punishments mentioned by respondents	Other Zambian studies referencing this rule
			the SMAG to escort you; you come with them here. [04-06-02]		
Rules during labour	Being clean and shaving pubic hair	6	They said when you come here, mothers should look clean. If you look clean, even the child inside will be clean, the baby movements will be okay. [03-06-02]	Disrespectful treatment, e.g. shouting and shaming	
	"Being strong", i.e.: not making noise or crying, and successfully pushing the baby out	6	They would ask, "have you had a child before?" I said no, she said you should be strong; motherhood is like this and like that. So, you should be strong, if you are not strong you can kill the child so you should be strong; you shouldn't be afraid of anything. [04-07-02]	Disrespectful treatment, e.g. shouting	(Phiri and Moland, 2014)
	Lying down and staying put during labour	4	Now the pain was too much so I was going down time and again, so she saw as if I was troubling her according to their instructions that they have put up. [03-09-02]	Disrespectful treatment, e.g. being ignored, shouting	
	Women's entourage not allowed in the labour ward	3	I – Yes, okay so why didn't you ask anyone to escort you? R – Why I didn't tell them? Because they already taught us here who we should come with, it's just those, after they bring me they go back, we just remain with the doctor. [04-02-02]	None specifically mentioned	
	Using a bucket instead of the toilet	3	The nurse said," If you feel like peeing, you should stand and pee in that bucket. If you feel like pooping, you poop in the bucket," I said, "Okay," [03-09-01]	None specifically mentioned	
	Obeying instructions	3	Because they had told me that "if you start doing that, the ambulance is there outside, they will use a knife, so, you should follow my instructions, I like people who follow what I instruct them. If I say, do this, they do, do this, they do, not when I say do this they are refusing to do and do something else". [03-09-01]	Disrespectful treatment, e.g. shouting, threats	
	Not doing heavy work	6	When I went to register at the hospital they stopped us from working hard chores, when a	Disrespectful treatment, e.g. shaming	

Rule category	Rule	n respondents	Illustrative quote	Punishments mentioned by respondents	Other Zambian studies referencing this rule
			woman is pregnant she is not supposed to do hard chores; she is supposed to do light chores because energy finishes. [04-09-02]		
	Staying active	5	They just told us not to sleep too long so that the baby should not move so we can give birth fast" [03-03-02]	None specifically mentioned	
Lifestyle rules during pregnancy	Eating well and dietary recommendations or restrictions	5	[…] not eating slippery things like okra, we have to [eat] vegetables mixed with pounded groundnuts, so that the child can grow healthy. [03-07-01]	None specifically mentioned	
	"Keeping well", i.e.: providing for and looking after yourself, your loved ones and your home	4	They were teaching us – how to prepare for the child when it's born, how to keep yourself, home and how to look after the husband. [04-04-02]	None specifically mentioned	
	Clothing restrictions	1	[…] we went to register at [rural place of clinic]. So what they tell us is that, "each pregnant woman should have a maternity (over dress)" [03-09-01]	None specifically mentioned	

Chapter 5: Challenging categorical thinking: An application to maternal healthcare access inequalities in Zambia (Paper 4)

This paper is intended for submission to Social Science & Medicine (Medical anthropology)

Table of Contents

Abstract

"Categorical thinking" in health inequalities research has been widely criticised by intersectional feminist scholars for treating social categories as natural, de-contextualised, and internally homogeneous. This critique has been echoed by anthropologists, sociologists and social epidemiologists. This paper proposes a new approach to the study of health inequalities that challenges categorical thinking, demonstrating the approach by explaining socio-economic inequalities in access to facility-based childbirth in Zambia. While recent innovations have focused on statistical methods for quantitative inter-categorical intersectional analysis across many points of intersection, this paper's approach is broader, employs mixed methods, and is not primarily inter-categorical in nature. It responds to the research agenda of intersectional social epidemiologists by considering the context-specific meaning of categories and the potential for heterogeneity, by analysing the social processes that might explain inequalities at multiple levels, and by framing analyses within the mutually constitutive forces that create categories and the inequalities between them. Challenging categorical thinking has important implications for social justice and health, by rejecting framings of a specific category as problematic or non-compliant, highlighting the possibility of change, and emphasising the political and structural nature of progress.

1. Introduction

Social categories are key to analysing health inequalities in quantitative studies. However, the prevalence of "essentialist" or "categorical thinking" in public health research, both quantitative and qualitative, has been widely criticised, particularly by intersectional feminist scholars (Bauer, 2014; Connell, 2012; Kumar, 2013). Aspects of these feminist critiques have been echoed by sociologists, social epidemiologists and anthropologists (Adams et al., 2019; Krieger, 2001; Øversveen et al., 2017). While the essentialisation of gender is perhaps more pervasive than that of socio-economic categories due to the more widespread assumption of gender's link with biology (Springer et al., 2012), "the mechanical concept of the social" in global health research and policy affects all social categories (Adams et al., 2019, p. 3).

Categorical thinking exhibits several inter-related characteristics, which together discourage productive analysis of the mechanisms behind health inequalities (Bauer, 2014). Firstly, the existence and definition of the category, as well as individuals' membership of a given category, are treated as 'obvious'/'self-evident'/'unproblematic' (Adams et al., 2019; Hammarström and Hensing, 2018; Westbrook and Saperstein, 2015). Secondly, categories are seen as 'fixed'/'unchangeable'/'constant' across space and time (Adams et al., 2019; Connell, 2012; Hammarström and Hensing, 2018). Thirdly, members of a given category are understood to be homogeneous while different categorical dimensions are seen as operating independently from each other (Crenshaw, 1989; Mohanty, 1984).

Fourthly, categorical thinking focuses on differences between categories rather than social processes, e.g.: focusing on class differences rather than systems of economic exploitation, sex differences rather than gendering processes, race rather than systems of racial oppression (Brewer et al., 2002; Choo and Ferree, 2010; Connell, 2012).

Challenging categorical thinking is important because failure to do so results in policies with a programmatic focus on individual-level behaviour rather than structural changes (Adams et al., 2019; Bauer, 2014; Kumar, 2013). Homogenising members of a category leads to policies designed for those who are relatively more advantaged or visible within a given category (Crenshaw, 1989). Categorical thinking focuses attentions on fixing "problem" categories rather than systems of privilege and oppression (Connell, 2012). Finally, categorical thinking's inability to explain inequalities continues to "*reinforce the intractability of inequity*" (Bauer, 2014, p. 12).

The aim of this paper is to develop a mixed methods approach to the study of health inequalities that challenges categorical thinking in an innovative way and responds to the research agenda raised by quantitative intersectional scholars. For example, Bauer (2014) emphasises the importance of using theory to explain health inequalities. She also insists on analysing mutually constitutive social processes rather than categorical difference and looking for explanations located at the structural level rather than simply relying on individual-level explanations. Lastly, she highlights the potential for quantitative work to contribute to intersectionality's empirical agenda. Evans (2019a) also emphasises the importance of investigating the macro, structural level to explain health inequalities. She similarly stresses the importance of using theory to guide analysis and to interpret descriptive findings. Finally, she urges quantitative scholars to pay attention to the social, context-specific construction of categories, and to how this context shapes the meaning of categories.

This paper's approach is demonstrated through an analysis of inequalities in access to facility-based childbirth in Zambia, between women of different socio-economic categories. This case was selected because categorical thinking is prevalent in health research about countries in the "Global South" (Adams et al., 2019; Kumar, 2013). Assumptions about the uniformity, inevitability, and Western-centric direction of "economic and social development" contained in modernization theories, and the construction of the formerly colonized as a uniform "other" for the purposes of colonial, post-colonial and neo-colonial projects, obscure the specificity of categorical meanings within time and space (Mohanty, 1984; Thornton, 2001). Intra-country inequalities in facility-based childbirth and skilled attendance at birth are much larger than inequalities in other primary care interventions, such as child immunisation (Boerma et al., 2018; Hosseinpoor et al., 2011). Access to quality care in childbirth is particularly important for avoiding maternal mortality (Campbell and Graham, 2006). Lastly, Zambia has high-quality geo-referenced secondary data on both facility childbirth and health facility infrastructure and staffing, making it possible to measure the meso-level health service environment and its contributing effect to healthcare access inequalities.

2. A six-step approach to challenging categorical thinking

This paper's approach follows six steps to explain health inequalities without resorting to categorical thinking (Figure 1). It challenges the notion that health(care) inequalities are obvious by:

(1) *Grounding empirical analysis in a theoretical standpoint: intersectionality.*

(2) *Using data at multiple levels (individual, household and health service environment) and employing mixed methods to test theoretical predictions.*

It challenges the decontextualized nature of categories by:

(3) Examining the context-specific meanings of socio-economic categories using qualitative data.

(4) Contrasting inequality analyses based on different measures of social status.

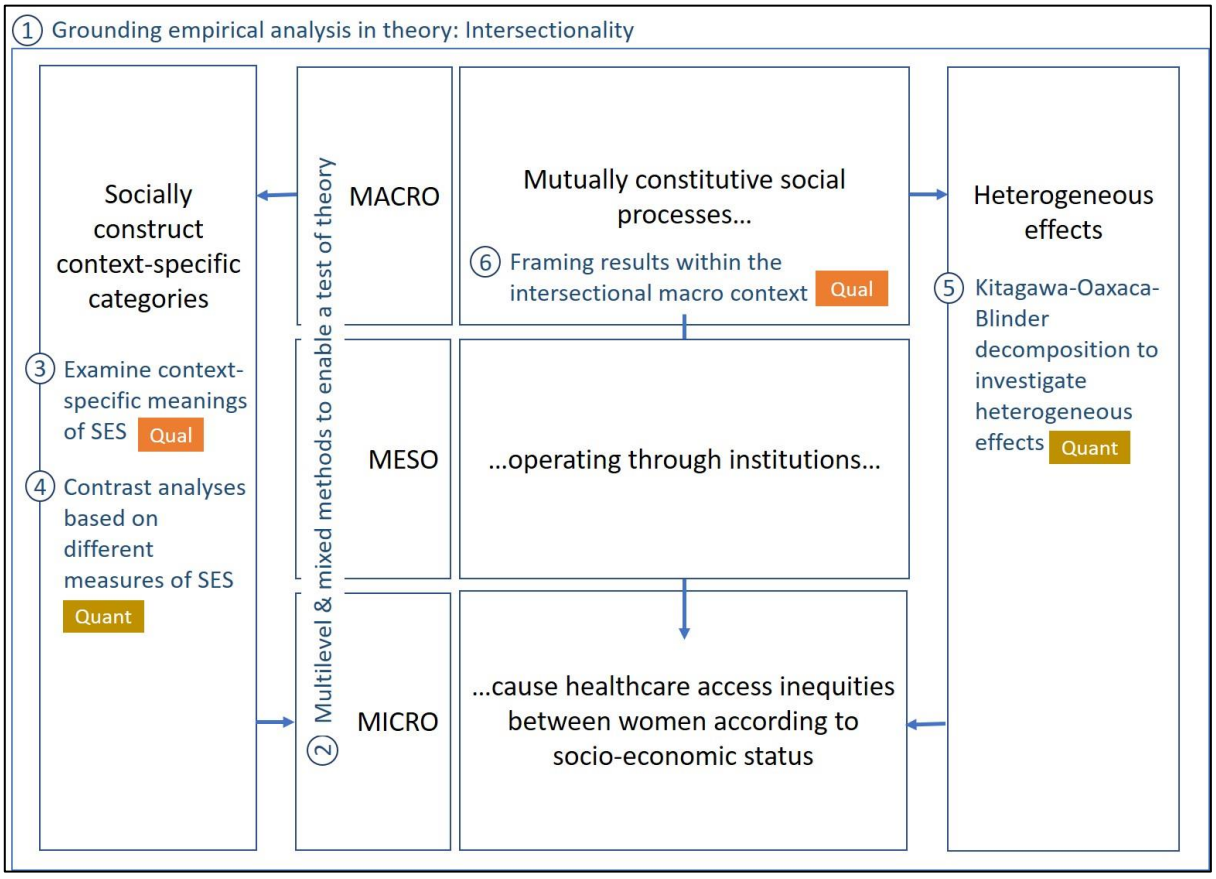
The paper challenges the assumption that there is homogeneity within categories, by:

(5) Adopting a quantitative method (Kitagawa-Oaxaca-Blinder (K-O-B) decomposition) that allows for heterogeneous effects.

Finally, it transcends categorical thinking's focus on differences between categories to emphasise the mutually constitutive macro-level social processes creating categories and the inequalities between them, by:

(6) Drawing on qualitative data and the literature to contextualise the study's quantitative results within a macro-level context of mutually constitutive power relationships.

Figure 1: Intersectional analytical framework and a six-step approach to challenging categorical thinking



Note: Intersectionality theory's premises, as applied to this case, are depicted in black writing. The six steps of this paper's approach are depicted in blue writing. SES: socio-economic status.

2.1. Overview of methods

Which methods are best suited to intersectional and non-"categorical thinking" research is hotly debated. Adams et al (2019) point to the limitations of social surveys and recommend a range of qualitative methodologies from participant observation to postcolonial studies. Bauer (2014) makes a case for quantitative data and methods in answering intersectional research questions, in terms of the ease with which the analyst can consider variation at different levels, not only across intersectional individual locations but also in the structural constraints individuals face. Choo and Ferree (2010) point

out that categorical thinking also exists in supposedly intersectional qualitative research, and argue for the use of mixed methods given their ability to incorporate analysis at multiple levels of social organisation.

A combination of qualitative and quantitative methods is applied in this approach (Figure 1). Thematic analysis of in-depth interviews supported by vignettes are used to understand the context-specific meaning of socio-economic categories. Geographic Information Systems (GIS) are used to link population-level data to facility-level data, thereby allowing explicit modelling of micro (individual and household attributes) and meso levels of analysis (health service environment). K-O-B decomposition is employed to explain inequalities with respect to these multiple levels, and to test for potential heterogeneous effects. In order to present this new approach in the most compelling way, methods are only briefly described in the body of the paper. Detailed explanation and justification of methods are provided in the Appendices 5.1-5.8.

3. Applying the approach to a case

3.1. Grounding empirical analysis in theory

Public health research, including work on health inequalities, has been widely criticised for being a-theoretical (Bauer, 2014; Øversveen et al., 2017). Categorical thinking implicitly assumes that the reasons behind health inequalities are obvious and tautologically explained by individuals' belonging to a given category. The first step of the approach is therefore to adopt an explicit theoretical standpoint. Use of theory allows for alternative assumptions to be made explicit, and to test their relevance (Bauer, 2014). This improves the quality of debate and accelerates progress towards reducing inequalities (Evans, 2019a; Hammarström and Hensing, 2018; Krieger, 2001).

The theoretical framework used in in this case is intersectionality, the main tenets of which are summarised in Figure 1. While intersectionality is an obvious choice given that many (though not all) critiques of categorical thinking originate from intersectional scholars, other theoretical perspectives could be valuable, depending on the case. Intersectionality is a research paradigm originating in the analytical contributions of Black feminist scholars in the US, in reaction to feminist thought that emphasised the experiences of White women, and critical race scholarship that emphasised the experiences of Black men. Scholars showed that Black women's experiences are not the sum of White women's experience of sexism and that of Black men's experiences of racism, but constitute a specific type of oppression (Crenshaw, 1989).

Its main theoretical premise is that the "*analytic categories and concepts (hierarchies, axes of differentiation, axes of oppression, social structures, normativities) are socially constructed and mutually modifying*" (Sigle, 2016, p. 222). From the insight that categories are socially constructed, intersectional scholars direct their attention to the social processes constructing these categories as explanation for inequalities between categories, rather than to assumed differences between the categories themselves (Choo and Ferree, 2010). Because these processes are social, these processes and the categories they create are analysed as specific to a time and place, shaped by prior history. It is further posited that these social processes are embedded within institutions, at multiple levels, and in multiple sites (e.g.: national policy, workplace, family, etc.) (Bauer, 2014; Gkiouleka et al., 2018). People are not fully constrained by these institutions, but have some agency both in terms of the social position they assume and how they affirm or resist these social processes (Choo and Ferree, 2010). The second key insight is that these social processes are mutually modifying – for example, the racial system does not operate in the same way for men and women, but interacts with patriarchy and gendering processes to modify the workings of racism according to gender (Connell, 2012).

3.2. Mixing data and methods to enable a test of theory

The second step of the approach draws on a combination of data and methods across a range of analytical levels. An analytical approach that combines multiple levels is important in order to test intersectional assumptions, which emphasise the importance of institutions (Choo and Ferree, 2010). Combining datasets may be necessary in order to use variables at the individual and the institutional level. A mixed methods approach draws on the strength of both quantitative and qualitative methods to examine a wider range of levels than may be possible in either methodological tradition (Choo and Ferree, 2010).

In this study, I use quantitative methods to explain socio-economic inequalities in women's access to a facility-based childbirth with reference to both micro (individual and household) and meso (health service environment) levels. I use qualitative methods to understand the context-specific meaning of categories and to interpret the quantitative analysis with reference to macro-level social processes.

3.2.1. Quantitative data and variables

In this study, Geographic Information Systems (GIS) are used to link population-level data to health facility-level data, thereby allowing explicit modelling of micro (individual and household attributes) and meso levels of analysis (health service environment). The Zambia 2010 Service Availability and Readiness Assessment (SARA) collected information on health facilities' location, staffing, infrastructure, and readiness to provide obstetric signal functions. The sample is comprised of all facilities located in 17 out of Zambia's 72 districts, irrespective of level or ownership. The second dataset is the 2013-14 Zambia Demographic Health Survey (DHS), a nationally and regionally representative two-stage cluster sampling household survey. It collects data from women of reproductive age, including their socio-economic and demographic characteristics and the place of delivery for births occurring in the five years prior to interview. The sample for this study only includes observations from the DHS sampling clusters located within the SARA dataset's 17 districts, and is comprised of 2,963 births. Further information on the datasets and sample is provided in Appendix 5.1.

The variables selected to measure the health service environment reflect six key dimensions of healthcare accessibility, according to three major "relational" healthcare access frameworks (Bertrand et al., 1995; Choi et al., 2014; Penchansky and Thomas, 1981; UN, 2000). A relational approach to the concept of accessibility defines access as the extent to which the health system is accessible relative to the population's varied needs, capacities and expectations (Ricketts and Goldsmith, 2005). While each of the variables only partially measures the dimension to which it is assigned, they were selected to reflect the context of maternal healthcare access in Zambia, informed by 12 key informants interviews (see Chapter 6 of this thesis for more details) and a Zambia-specific literature review. These "health service environment" variables explain an important share of the variance in facility delivery in Zambia (Paper 1, this thesis). While the selected variables do not perfectly or comprehensively represent each accessibility dimension, they have relevance and legitimacy in the Zambian context, are available for the vast majority of the study's sample, and are measured using good quality data. The accessibility dimensions are all formulated as access barriers when operationalised as variables (i.e. =1 if the accessibility dimension is not present for a specific birth).

Individual or household attributes might also affect women's access to a facility birth, be associated with aspects of the health service environment, and be unequally distributed according to socio-economic status (SES). Including them is therefore important in order to partly address omitted variable bias. Selection of these attributes was also informed by key informant interviews, in-depth interviews with women who had recently given birth (Paper 3 and Chapter 6 of this thesis), and by the maternal healthcare access literature in Zambia (e.g.: Chibuye et al., 2018; Kaiser et al., 2019a;

Mulenga et al., 2018; Scott et al., 2018; Sialubanje et al., 2015, 2014b). Variables that measure the accessibility dimensions in a different way were excluded from consideration. Apart from mother's age at birth, all variables are measured at the time of interview, as they were not available at the time of birth. A more detailed explanation of variable selection, descriptive statistics, and results of an OLS regression of facility delivery on these variables are provided in Appendix 5.2.

Table 1: Key concepts, definition of chosen variables & data sources

Concept	Variable definition	Data source
OUTCOME VARIABLE:		
Facility birth	Whether a birth occurred in any health facility	DHS 2013-14
HEALTH SERVICE ENVIRONMENT VARIABLES:		
Affordability barrier	Mother's household was in the two poorest wealth quintiles at the time of interview	DHS 2013-14
Cognitive barrier	Birth has a birth order of two or above	DHS 2013-14
Psychosocial barrier	Birth has a birth order of six or above	DHS 2013-14
Geographic barrier	The mother's DHS sampling cluster at the time of interview was further than 10km from any health facility, measured as a straight-line distance	DHS 2013-14 & SARA 2010
Availability barrier	The mother's DHS sampling cluster at the time of interview was further than 10km from any health facility with at least one midwife, measured as a straight-line distance	DHS 2013-14 & SARA 2010
Perceived quality of care barrier	The mother's DHS sampling cluster at the time of interview was further than 10km from any health facility with the capacity to provide Comprehensive Emergency Obstetric Care, measured as a straight-line distance	DHS 2013-14 & SARA 2010
INDIVIDUAL & HOUSEHOLD ATTRIBUTES:		
Average autonomy	% wives in the mother's DHS sampling cluster who report: - joint decision-making on own healthcare (omitted cat); - husband decides on own healthcare; - they decide by themselves on own healthcare	DHS 2013-14
Literate	Mother is literate	DHS 2013-14
Age at birth	Age of mother at the birth	DHS 2013-14
> 1 woman of reproductive age in HH	Whether there was more than one woman of reproductive age in the mother's household	DHS 2013-14
Married	Mother is married	DHS 2013-14
Occupation	Categorical variable with three levels: working in a non-agricultural job; not working; farm work	DHS 2013-14

3.2.2. Quantitative analysis

K-O-B decomposition[20] is employed to explain inequalities in facility birth in Zambia. I use decomposition analysis to quantify the percentage of SES inequality in facility birth that is explained by dimensions of the health service environment, rather than individual or household attributes. In

[20] A technique developed by demographer Evelyn Kitagawa (1955) twenty years prior to economists Oaxaca (1973) and Blinder (1973).

general, decomposition techniques quantify the contribution of a given variable to inequality by estimating both the association of this variable with the outcome (in this study, the outcome is access to a facility delivery) and the differential distribution of this variable across categories (in this study, high vs. low SES categories). Variables that are both unequally distributed across SES categories and are highly associated with access to a facility birth explain a large proportion of the SES inequality in facility delivery.

K-O-B decomposition further allows the effects of explanatory variables on the outcome to *vary* across high vs. low SES categories, enabling an exploration of heterogeneity. This is similar (in spirit) to including an interaction term between the SES variable and the explanatory variable in a regression. K-O-B therefore provides information on the extent to which SES inequalities in facility birth are driven by the differential distribution of explanatory variables across SES categories (the "level" part of inequality) – e.g. do the poor live further away from the health facility compared to the rich – versus the unequal effect of explanatory variables on facility birth across high vs. low SES categories (the "effect" part of inequality) – e.g.: does distance discourage access for the poor to a greater extent than for the rich. Further explanation on K-O-B decomposition and its assumptions is provided in Appendix 5.3.

3.2.3. Qualitative data and analysis

This paper makes use of qualitative data in two ways. Firstly, qualitative data is used to challenge the decontextualized nature of categories by revealing the meaning of categories in a specific time and place. Secondly, it is used to interpret the quantitative results in a way that incorporates mutually constitutive, macro social processes. Bringing in this context through alternative data sources is important since this study's quantitative data is limited to women within Zambia (making relations between men and women and between colonial states invisible). While differences between people of different SES are included in the quantitative analysis, the power relations between them are not, and the intersectional relationships between class relations and other macro factors also remain obscured.

The qualitative data were generated through in-depth interviews [n=42] with women who had given birth in the previous year, supported by verbal and visual vignettes. The interviews were conducted in Bemba (one of the main Zambian languages) in May-June 2018. Women were recruited from a mix of urban and rural health centres offering infant immunisations in a specific district in Zambia, purposefully selected to represent a wide range of social identities. Transcript passages coded as discussing differences in pregnancy, birth, or general life experience according to SES were retrieved. The author conducted a thematic analysis of these, separately for education, wealth, and rural-urban differences. Detailed information on qualitative data collection and tools are provided in Appendix 5.4, as well as Paper 3 and Chapter 6 of this thesis.

3.3. Examining the meaning of SES categories

The third step of the approach challenges the decontextualized use of categories. Analysing categorical difference in a way that ignores the specificity of time and place is one of the hallmarks of categorical thinking (Adams et al., 2019). This is also the part of the categorical thinking critique most ignored by quantitative intersectional studies (Evans, 2019a). Understanding the meaning of categories in a specific place matters because it reminds us of the social construction of categories, a process which is itself implicated in the creation of health inequalities. In doing so, it connects the analysis to the macro social processes that are more likely to be absent from quantitative models (Evans, 2019a). Since this study aims to explain socio-economic differences in maternal healthcare access, I therefore define the complex and multidimensional concept of SES and analyse the situated meaning of different SES categories in Zambia today.

3.3.1. Defining SES and introducing quantitative SES measures

SES in this study is defined as the extent to which individuals, households, and communities have access to *material resources* (money, infrastructure), as well *prestige* or influence. Better access allows people to have better control and autonomy over their own life, as well as power over others. This study's conceptualisation of SES blends "resource" and "rank" approaches to SES (Krieger et al., 1997).

In this study, SES is measured using three variables: the rurality of the DHS sampling clusters, household wealth, and mother's education (Table 2). Occupation of the mother was considered but not selected because of the differential meaning of work across social classes (Section 3.6). I chose to conduct the analyses with respect to three different dimensions of SES for several reasons. Firstly, SES is a complex social construction that cannot easily be summarised by a single variable. Many studies have shown that different measures of status are not interchangeable (e.g.: Braveman et al., 2005; Regidor, 2006). Contrasting results across different measures of socio-economic status reveals the specific meaning of each of these SES measures, as well as what they have in common. This process improves our understanding of these categories and triangulates findings. Secondly, scholars of health inequalities emphasise that studies should include or at least consider a range of levels at which SES can be defined (individual, household, neighbourhood) (Braveman et al., 2005; Krieger et al., 1997). Finally, one of the measures of SES, wealth, is also used as a measure of affordability (section 3.2.1), which creates problems for the interpretation of the quantitative results. Contrasting the results for wealth inequalities with the results of the other two dimensions helps to alleviate this limitation.

All three SES concepts are important and inter-related markers of SES in Zambia (Cole et al., 2015; Evans, 2018b; Phiri and Abebe, 2016; White and Jha, 2018), and determine who accesses maternal healthcare in Zambia (Pons-Duran et al., 2016). SES variables were operationalised in a binary way because this is required by K-O-B decomposition. While these three ways of measuring SES are correlated (Appendix 5.5), they were also chosen to illustrate different dimensions of SES. Education is measured at the individual level, wealth at the household level, and rurality at the neighbourhood level. As the next section shows, each of these SES variables also have different gendered meanings in terms of access to resources and prestige.

Table 2: SES variable definitions

SES variables	***Variable definition***
Urban/Rural	Defined at the sampling cluster level, on the basis of rural-urban definitions used by the Zambia statistical office (urban areas are "localities of 5 000 or more inhabitants, the majority of whom all depend on non-agricultural activities" (United Nations, 2006)).
Wealth	Top three wealth quintiles (=not poor) vs. bottom two wealth quintiles (=poor)
Education	Some secondary school and above, vs. no secondary school and below

3.3.2. Analysing the situated meaning of SES categories

In this section, I draw on primary qualitative data to understand the context-specific meaning of three SES dimensions in Zambia today. These are the SES dimensions that define the inequalities in facility birth which this study seeks to explain: rural-urban, education, and wealth inequalities in facility birth. This step of the approach contributes to challenging the decontextualized use of categories and serves to interpret later quantitative findings as embedded in social processes that create the categories and the inequities between them. The purpose of this section is not to describe the "true" meaning of each category, but to illustrate what respondents believe they mean for women, particularly in relation to pregnancy and childbirth.

Four key findings emerge. Firstly, all three dimensions of social status are composed of meanings relating to both material resources and social prestige. Secondly, there is strong evidence that for

some women, financial resources depend on social support in a way that is strongly gendered. Thirdly, the categories "rural", "poor", and "uneducated" are deeply stigmatised, with narratives of personal responsibility driving disadvantage. Lastly, more advantaged categories and their behaviours are associated with modernity and development, whereas other behaviours are characterised as traditional and backward, in a way that is deeply moralised.

Urbanicity and rurality

The meaning of urbanicity is strongly connected to better employment opportunities, which can enable gendered independence: "*if she was living in town, she would have found a job to work. She would have fought for her livelihood in town."* [03_10_01]. This is contrasted with hard physical labour in rural areas: "*[…] in this village there is nothing but suffering, every day one has to go in the bush [to farm]" [04_05_02]*. The greater availability of resources in urban areas extends to public infrastructure: in town, "*the health facilities are nearby*" and "*everything is available […] unlike rural areas*".

The prestige element of towns relative to villages is linked to a contrast between 'modern' and 'traditional' ways of being. Rurality's assumed connection to traditional medicine, for some respondents, is associated with backwardness in opposition to "modern" knowledge. This is illustrated through disapproving respondents' depictions of those who use traditional medicine in childbirth: women living in the fieldwork district (which is predominantly rural and remote); uneducated women; those influenced by grandmothers; those in polygamous marriages; non-Christians. The traditional versus modern tension is also illustrated by narratives of rural "progress". Whereas "*elders*" used to hold knowledge and advise women in rural areas on how to give birth and look after children, now it is "*the government*", and people "*from different places and Lusaka*" *[03_09_02].*

Wealth and poverty

Poverty was summarised as not "*living well*" or not "*keeping well*". The main sign of not keeping well is not having enough food, but it also has broader meaning around being cared for or caring for oneself and one's household "*properly*". Wealth, in contrast, was imagined as a state free from worry about how to meet basic needs. Respondents explained that poverty can result from women's inability to claim support from their social network, including husbands, fathers of their child, relatives, and friends (also noted in White and Jha (2018)). This is particularly true in pregnancy, when the woman and baby need additional resources (e.g. special and additional food, new clothes, birthing materials), and when the woman is less able to do physical work in the fields. The importance of social networks for avoiding poverty can also be seen in the language and discourse around financial well-being – "keeping well" is closely tied to "being kept" (being provided for, e.g. by one's husband, parents, aunt) and/or "keeping others" (e.g. providing for children, an elderly mother, etc.).

Women's poverty was highly moralised. In-depth interviews demonstrate that personal responsibility is heavily emphasised in discussions of female poverty, with visible markers of poverty being interpreted as a lack of personal dignity (*"we do not care for ourselves")* and lack of respect for the health facility (*"[dressed] like you are not going to the facility")*. Women who fail to save for the materials required in childbirth are not "*in their right mind*" because "*We work for it, you can even ask for piece-work from your friend" [04_06_03].* Women are seen as responsible for their failures, since it is believed that there are always opportunities to get money through working and mobilising social networks. This is true despite the husband or father being constructed as the person primarily responsible for bringing material resources to the household, including during pregnancy. Poor women are additionally blamed for getting pregnant if they are unmarried or have "too many" children: *"[…] they label them to be like they are bad people why get pregnant when you don't have a husband or why get pregnant when you can't afford." [03_04_01]*. Given the importance of social

networks for avoiding poverty, it is possible that the poor are additionally stigmatised because their poverty speaks of social exclusion and therefore social deficiency (White and Jha, 2018).

Education

The meaning of education is similarly connected to both prestige and resources. On the resources front, education is valuable because it enables women to access "*a government job*" or "*a job in town*" (also described in: Evans, 2018a). Without a formal job, which is contrasted to working "*in the bush*", education is "*just a name*". An educated woman with a job can provide for herself and her children without having to be married (or being dependent on her relatives). Education that leads to a 'good' job also represents a gendered path to material independence: "*I mean she can provide for herself." [03_04_01]*.

Education is also about prestige: more educated women are more likely to be included in community groups or chosen as community health volunteers: "*they choose that this one has been to school and is the right person." [03_06_01].* Educated women align themselves with health facilities' biomedical knowledge, and away from "*traditional*" knowledge. In practice, this means they believe in spacing and limiting their pregnancies, as well as giving birth in the health facility: *"maybe the one that is [gives birth at] home has never been to school, they have never learnt." [04_07_02]*. Uneducated women are seen as "*backward"* and "*ignorant"*, particularly in terms of their choices in pregnancy and childbirth, and blamed for their lack of knowledge: *"lack of education forces you from good things but you force yourself [you choose not to know], it is just lack of education." [04_10_01]*.

3.4. Quantitatively explaining inequalities at multiple levels

Next, the approach challenges the notion that explanations of health inequalities are obvious or necessarily located at the individual-level, by investigating the role of the health service environment (a "meso" explanatory level) in explaining maternal healthcare inequalities in Zambia, using K-O-B decomposition, which also allows for heterogeneous effects.

The mean inequality between high and low SES categories is shown under "*differences in mean access*" in Table 3. Each of the coefficients in Table 3 indicates the contribution of that variable to this mean inequality. For example, the differential effect of the cognitive barrier for rural vs. urban births contributes 5 percentage points (p.p.) out of the total 32 p.p. mean difference in access to facility birth across rural vs. urban groups. The contribution of each variable can be positive or negative. A negative contribution means that the variable creates a pro-privileged disparity.

3.4.1. Health service environment or individual attributes?

The mean difference in access to facility delivery between high and low SES categories ranges from 32 percentage points (rural-urban) to 22 percentage points (education) (Table 3), relative to an average level of access of 74% in the sample (Table A5.1). Further description of inequality levels, using concentration indices and investigating intersectional inequalities between different SES dimensions, is provided in Appendix 5.6.

Depending on the SES dimension, health service environment variables across high and low SES categories explain between 75 and 84% of "Levels" inequality in access to facility delivery (Table 3)[21].

[21] This is not the same as the % of the total inequality explained by health service environment because it leaves out the contribution of the HS environment to "Effects" inequality. The HS environment variables explain 11% (wealth), 78% (rural-urban) and 96% (education) of the "Effects" inequality (Appendix 5.7); however this is less interpretable because these results are not invariant to the choice of scale (Appendix 5.3). When using a decomposition method that does not allow for differential effects, i.e. concentration index decomposition, the health service environment explains between 65% and 84% of the inequality in facility birth (not shown).

The health service environment variables together summarise how health services are structured, both geographically and through systems of explicit or implicit discrimination connected to the social meanings of SES categories. This result indicates strong support for the hypothesis that institutions explain inequalities in healthcare access.

Across all measures of SES inequality, a much larger share of inequalities is explained by different propensities to face negative health service environments or attributes ("levels"), relative to differential effects of these environments ("effects"). Differential effects of explanatory factors across high vs. low SES levels only explain 16% (education) to 30% (rural-urban) of SES inequalities (Table 3).

How exactly do the better-off use their power and resources to select into better health service environments? It is not simply that influence and resources enable individuals to locate in better places (e.g.: educated women can find a job in town) or that the social locations which high-SES women inhabit carry prestige, thereby protecting them from stigma and maltreatment in health facilities (Link and Phelan, 1995). The very definition of what counts as a good or bad geographic or social location is continuously shaped over time, at multiple levels, by those with more power and resources. Rural areas continue to be "under-served" because those with power are not located there. High birth orders continue to be stigmatised because prevailing and mutually constitutive power dynamics have constituted large families as "unmodern".

3.4.2. Heterogeneous effects

While differential effects of the health service environment or individual attributes explain a smaller portion of the inequality, it is interesting to examine where the effects differ. In this section, I demonstrate that some determinants have heterogeneous effects on maternal healthcare access, representing resources or constraints depending on women's social location and the context-specific social norms attached to that location. I only discuss a subset of the statistically significant heterogeneous effects (Table 3): those which pertain to one of the cross-cutting themes of Section 3.3.2, the enmeshment of social and financial support for some women in Zambia.

Table 3: Kitagawa-Oaxaca-Blinder decomposition of inequalities in facility delivery (Zambia 2013-14)

	Rural-urban	Wealth	Education
Mean access privileged group	0.93**	0.84**	0.89**
Mean access disadvantaged group	0.61**	0.59**	0.66**
Difference in mean access	0.32**	0.25**	0.23**
Total "Levels" inequality (%)	0.22** (70%)	0.18** (72%)	0.19** (84%)
Total "Effects" inequality (%)	0.10** (30%)	0.07** (28%)	0.04 (16%)
"Levels" inequality (summary)			
Health service environment (%)	0.19 (84%)	0.14 (77%)	0.14 (75%)
Individual & household attributes (%)	0.04 (16%)	0.04 (23%)	0.05 (25%)
"Effects" inequality			
Health service environment			
Affordability barrier	0.01	NA	0.01
Cognitive barrier	0.05*	0.02	0.03
Psychosocial barrier	-0.01	-0.03*	-0.02**
Geographic barrier	0.00	-0.01	-0.01
Availability barrier	0.01	-0.01	0.00
Quality of care barrier	0.02	0.03	0.02
Individual & household attributes			
% of wives who decide by themselves	-0.03	-0.05	-0.05*
% of wives who say husband decides	-0.05**	-0.07**	-0.05**
Literate	0.00	0.00	-0.03
Age at birth	0.24**	0.30**	0.20**
> 1 woman of reproductive age in HH	-0.02*	-0.01	-0.01
Married	-0.02	-0.02	-0.06*
Not working	0.02	0.04**	0.01
Farm work	0.02	0.01	0.00
_cons	-0.14	-0.14	0.00

Note: ****** significant at the 5% level; ***** significant at the 10% level. Standard errors clustered at the DHS sampling cluster level. See Appendix 5.7 & 5.8 for the full models, including coefficients for "Levels" inequality, as well as standard errors and P-values for all coefficients.

The three heterogeneous effects of interest are: the differential effects of "not working" (for wealth inequality); "married" (for education inequality); and "% wives who say husband decides"[22] (for all SES inequalities).

Being out of work has no effect for women who are not poor (this might indicate a middle-class male breadwinner model) but a strongly negative effect for women who are poor (Appendix 5.8). Being married has a negative effect for more educated women but a positive effect for less educated women, who may have a greater need for financial support from their partner (Appendix 5.8).

"Autonomy" of decision-making is another particularly interesting example. In the maternal healthcare access literature (and in most of the psychological wellbeing literature (White and Jha, 2018)), "autonomy" is unproblematically positioned as a positive attribute. It has been found to be positively associated with facility delivery in reviews of studies spanning low-and-middle-income countries, Sub-Saharan African countries (Gabrysch and Campbell, 2009; Moyer and Mustafa, 2013)

[22] See Appendix 5.2 for a full explanation of this variable

and for Zambia specifically (Banda et al., 2016). Previous studies showed that autonomy is more important for wealthy women, including in Zambia (Banda et al., 2016; Moyer and Mustafa, 2013). In this study, socio-economic position does modify the association of autonomy with facility delivery, but not in the expected way. For more advantaged women, there is no statistically significant difference in facility delivery according to decision-making practices in the community. For less advantaged women, however, a greater % of wives who say their husband decides alone has a large and statistically significant positive effect on facility delivery relative to % of wives who say it is a joint decision (and controlling for the % of wives deciding alone) (Appendix 5.8).

The implications of work, marital status, and community-level norms around decision-making for access to facility birth are therefore not uniform and depend in important ways on socio-economic status. They show that financial and social support are linked – particularly for less advantaged women, who may not have independent means of support. It is particularly important for them to be able to rely on their social network, primarily their spouse, for financial support in pregnancy and childbirth (and beyond). This is further emphasised by White and Jha in their ethnography of wellbeing in rural Zambia: *"Discussion of autonomy and relatedness is grounded in the quotidian demands of making and sustaining a living. Success inheres not in independence, but the successful cultivation of dependence – whether as one who is needy and able to press one's claims, or as one whose power is demonstrated through the ability to command and support others"* (White and Jha, 2018, p. 155).

3.5. Framing results within the intersectional macro context

Up to now, this paper's explanation of socio-economic inequalities in maternal healthcare access in Zambia has emphasised the meso-level context (health service environments). The quantitative analysis' exclusive focus on women prevents quantitative explanations related to gender relations, while its focus on contemporary Zambia (rather than a broader setting across time and place) precludes an analysis of enduring colonial or neo-colonial influences (Connell, 2012). Feminist and critical race scholars have questioned these analytical practices and the real world implications they have in terms of framing solutions to health inequalities as technocratic rather than political (Kumar, 2013). The final step of this approach therefore makes visible the mutually constitutive, macro-level context of power relationships that influence both the creation of categories and the inequalities between them. In order to do so, I draw on primary qualitative data and the social science literature on Zambia.

Firstly, gender relations play a key role in shaping maternal healthcare access inequalities by SES. Access to maternal healthcare requires some women to rely on men's financial and symbolic support. Financial resources are needed to purchase transport and materials required by the facility for delivery (Paper 3 of this thesis), while gender relations construct the man as the primary household provider (Kaiser et al., 2019a; White and Jha, 2018). Education and the formal job opportunities it brings, particularly in urban areas, offer women a privileged path to financial independence that is differentially available across rural-urban areas and different socio-economic origins (Evans, 2018b), also evidenced in my qualitative data.

In some parts of Zambia, the male partner must be present for the pregnancy to be registered at the antenatal clinic and for the woman to receive care, which presumes that the man has either publicly recognised the pregnancy as his or that he is married to the pregnant woman (Paper 3 of this thesis; Sialubanje et al., 2014a). Becoming married and engaging in sex outside of marriage are behaviours that are themselves shaped by economic necessity and opportunity costs (Evans, 2018b; Heslop and Banda, 2013). Gender relations contribute to the moralisation of women's sexual and reproductive behaviour, influencing health worker-patient relationships at birth. My qualitative data

shows that poor women having "too many" children and unmarried pregnant teenagers are blamed as irresponsible, including by health providers.

Gender relations have been historically influenced by colonial powers, through their efforts to create "respectable", "modern" families in their image. Matrilineal Bemba women[23] had greater financial independence from their husbands prior to the mid to late colonial period (1920s-50s), when laws and policies were enacted to limit women's ability to work in urban areas and when wage labour in mines enabled men to become sole household providers (Evans, 2014a). Christian missionaries, and later mining companies, taught European gender roles of that era to miners' wives in "homecraft" and "mothercraft" classes (Ferguson, 1999). Zambian has been declared a Christian nation since the 1990s, with important implications for gender relations in policy and politics (Haaland et al., 2020).

Part of the reason why women require substantial financial resources for facility delivery is that health facilities lack key items such as disinfectant, cord clamps, plastic sheets, buckets, etc (Chibuye et al., 2018; Kaiser et al., 2019a; Mulenga et al., 2018; Scott et al., 2018). Zambia's economy was strongly affected in the 1980s with a collapse of the global price of copper and general economic downturn (Ferguson, 1999). This led to Structural Adjustment Programmes and a neo-liberal policy orientation in the 1990s, an approach spearheaded by the IMF and the World Bank globally, which resulted in the shrinking of the state with negative consequences for public services (Hansen, 2005). Zambia's health sector remains dependent on external development assistance, with fluctuations in coverage and health outcomes observed as a result of aid volatility (Chansa et al., 2018; Jackson et al., 2020; Usher, 2015).

Finally, biomedical childbirth is a symbol of "modernity" and "development". The meaning of modernity is strongly influenced by ideas of developmental idealism, spread through European colonial endeavours[24] and the subsequent world balance of power. Developmental idealism posits that "modern society" (based on Western culture) is good, attainable and the pinnacle of development. In turn, modern society and families (use of contraception, low fertility, birth in hospitals) are believed to be required for economic development (Thornton, 2001). This is clearly expressed by respondents in my qualitative data: *"[…] when you give birth [at the clinic], they [health workers] feel happy because they know that development is going forward at the clinic." [03-06-03]*, and has also been documented in India (Van Hollen, 2003, p. 210) and the Democratic Republic of Congo (Hunt, 1999, p. 13). For Zambian policy-makers, having a lower national rate of facility delivery compared to neighbouring countries such as Zimbabwe was a national embarrassment (Evans, 2018a).

Because biomedical childbirth is portrayed as a moral, "modern", "enlightened" choice, women who do not give birth in a facility are portrayed as backward and immoral, and punished by health workers, traditional authorities and their peers for their betrayal of national development objectives (Paper 3 of this thesis). Those who are not wealthy, urban and educated, in a word – modern – are penalised for their lack of modernity even if they do access a facility delivery, since the rules of the

[23] The Bemba are the majority ethnicity of the Copperbelt and the largest ethnic group in modern-day Zambia.

[24] In some colonies, such as the Belgian Congo or colonial Kenya, maternity hospitals were set up by Christian missionaries, the colonial state or private colonial enterprises (Hunt, 1999; Thomas, 2003). The goals of such endeavours were to boost population for capitalist exploitation, better count and thereby govern the indigenous population, and accomplish a "civilising mission" by ending previous "barbaric" birthing practices. Though there is a lack of historical research on the origin and motivation of biomedical birth in Zambia, owners of the Copperbelt mines would have benefited from maintaining or growing the population of indigenous workers. Further, in contrast with colonial Zimbabwe, colonial Zambia had a much lower concentration of European settlers who had an interest in limiting the indigenous population's numbers in order to maintain political control and secure land (Kaler, 2003).

health facility are designed to produce a "modern", "respectable" woman. For example, women are told in antenatal care that they were not allowed to undertake hard labour during their pregnancy, an impossible injunction for some rural women who had to carry out extra agricultural work in order to have enough food post-partum (Paper 3). Inequalities of wealth, residence and education shape inequalities in facility delivery. However the meaning of facility delivery and the way it is organised as a social interaction (influenced by gendered process and colonial history) also reinforces and shapes what it means to be a poor, rural, and uneducated woman (Spangler, 2011).

4. Limitations

The empirical analysis presents several limitations, including in its application of the approach outlined in the paper. While the context-specific meanings of the explanatory variables were not interrogated as thoroughly as the socio-economic categories, this does not imply that they are less of a social construction. The K-O-B decomposition highlights how the association between these variables and access to facility delivery changes according to the dimension and level of SES, implying heterogeneity of meaning within these categories of marital status, employment, or "autonomous" health-seeking behaviour.

The qualitative analysis was limited by the sample being solely comprised of women who had recently given birth. Because of the socially constructed nature of SES categories, it would have been useful to interview others about the meanings of these categories, such as men, relatives, health workers, and policy-makers. The qualitative data comes from a district in Northern Zambia, Mansa, whereas the quantitative data is sourced from across nine provinces. In order to partially address this limitation, Zambian studies conducted in other places across the country were drawn upon to confirm the qualitative findings where feasible.

The variables define some individual characteristics (poverty, birth order) as affordability, cognitive or psychosocial barriers, which are part of the health service environment. It is therefore unsurprising that health service environments, which comprise the affordability barrier, are an important explanation for wealth inequalities (Appendix 5.7). This limitation has been partly addressed: inequalities are explained according to multiple socio-economic dimensions, instead of simply analysing inequalities by wealth. There is strong evidence that these variables constitute valid (though imperfect) measures of affordability and cognitive or psychosocial barriers, based on 12 key informant interviews (KII) and other evidence from Zambia (further detail on the KIIs is provided in Chapter 6 of this thesis).

Finally, the estimated importance of "effects" vs. "levels" explanations of inequalities in the K-O-B decomposition, and the unbiased identification of heterogeneous effects, depends on the assumption that there are no omitted variables correlated with the explanatory variables and facility delivery. Since it is likely that omitted variables exist, it is possible that differences in coefficients between high vs. low SES groups might be due to differences in the levels of omitted predictors. This is not a big problem for two reasons. Firstly, I show that heterogeneous levels matter more than heterogeneous effects – including omitted variables would simply accentuate this result. Secondly, I do not interpret heterogeneous effects as causal, but as an instructive description of social patterns. For example, I show that being out of work has no effect on facility delivery for women who are not poor, but a strongly negative effect for women who are, and I interpret the fact of 'not working' as having a different meaning relative to women's financial and social resources for those who are poor relative to women who are not.

5. Discussion

The approach demonstrated in this paper challenges categorical thinking in health inequalities research. Its main features involve theoretical grounding across multiple levels of social processes; mixed use of data and methods to respond to these challenging research questions; examining the context-specific meanings of socioeconomic categories; including different measures of social status in inequality analyses; considering the heterogeneous effect of explanatory variables across socio-economic categories; and finally contextualising the study's results within macro-level, mutually constitutive and unequal power relations.

Through applying this approach to the case of maternal healthcare access inequalities in Zambia, we learn that socio-economic inequalities in access to facility childbirth are shaped by gendered social processes, colonial legacies, and the contemporary global balance of power. Financial and social resources are important for healthcare access. Some women's financial resources are connected to social support, in a way that is heterogeneous and strongly gendered. Less advantaged SES categories are deeply stigmatised, with narratives of personal responsibility driving disadvantage. This stigma is connected to moralised narratives of modernity and development, contrasted with traditionalism and backwardness. These mutually constitutive social processes operate at least partly though meso-level institutions, health service environments, which structure opportunities for access according to both geographic and social location. Across all three socio-economic dimensions, the health service environment explains a greater share of inequalities in access to facility delivery than individual, household and community attributes.

How innovative is this paper's approach? Grounding analysis in theory and using appropriate methods for the research question is arguably "just" good social science, and has been advocated by many theorists, most notably Nancy Krieger in the field of health inequalities. Acknowledging the socially constructed nature of categories, the potential for heterogeneity, and the workings of power at all levels has long been the hallmark of intersectional feminist theorists. Evans (2019a) argues that most intersectional studies are either "specific" (focusing on a few categories), analytical, and qualitative, or "comprehensive (large number of intersected categories), descriptive, and quantitative. This paper's approach is innovative in that it falls in the middle of this spectrum: it is specific, analytical, and uses mixed methods.

This paper's approach is also innovative with respect to another highly influential typology by McCall (2005): inter-categorical, intra-categorical, and anti-categorical approaches to intersectional complexity[25]. While recent innovations have focused on the development or new application of statistical methods for quantitative inter-categorical intersectional analysis across many points of intersection, this paper's approach is both broader and not primarily inter-categorical in nature. It is broader because it goes beyond the study of heterogeneity within commonly defined categories to consider the context-specific meaning of such categories, social processes at multiple levels, and the mutually constitutive forces creating the categories and the inequalities between them. It is not primarily inter-categorical in nature, in that it seeks to explain inequalities between women of higher and lower SES, rather than a greater number of intersections. This paper's approach combines aspects

[25] McCall (2005) organises intersectional studies into three perspectives: (1) Anti-categorical studies reject the usefulness of categories such as gender and class altogether, and see the categories themselves as creating the inequities they describe. (2) Intra-categorical studies focus on a particularly neglected point of intersection, describing the experiences of this social location (e.g. queer women of colour) and contrasting it with a privileged location (e.g. white heterosexual cis-women). (3) Inter-categorical studies explore how the effect of belonging to a range of different oppressed or privileged categories modifies outcomes of interest beyond what we would expect from the additive effect of these categories.

of the anti-categorical approach (by revealing the socially constructed and context-specific nature of the categories analysed), the intra-categorical approach (by examining differences within women) and inter-categorical approach (by allowing the effect of healthcare barriers and individual or household-level attributes to vary according to low or high SES).

Finally, most quantitative intersectional studies analyse health inequalities in the Global North (e.g.: Axelsson Fisk et al., 2018; Bauer and Scheim, 2019; Evans and Erickson, 2019; Wemrell et al., 2017b), despite studies in the Global South being particularly vulnerable to categorical thinking (Adams et al., 2019; Kumar, 2013). For example, the majority of decomposition studies focusing on maternal and child health inequalities in the Global South rely exclusively on individual or household attributes, and either do not take the health service environment into account, or proxy for it using unreliable variables on self-declared access problems. Most of these studies use concentration index decomposition methods that do not allow them to differentiate between the role of differential levels of explanatory variables across SES and the role of differential coefficients. Recent exceptions include Blunch et al. (2020) for child health in India and Johar et al. (2018) for general healthcare access in Indonesia, which also apply Kitagawa-Oaxaca-Blinder. The approach described in this paper uses data widely available in the Global South (DHS) as well as geo-referenced data on health facilities that have become more available over time (Ruktanonchai et al., 2016; Wong et al., 2020). The approach I have established is applicable in any context, data permitting.

Going beyond categorical thinking is not merely good social science. It has important practical implications for social justice. Analysing social processes rather than categorical difference avoids framing a specific category as problematic or non-compliant, against which punitive action such as fines or denial of healthcare must be taken (Choo and Ferree, 2010). Locating categories and the inequalities between them in a specific context of time and place implies the possibility of change (Connell, 2012). Finally and most importantly, identifying how power relations operate at multiple levels, reinforcing one another, implies that structural, political change is important to reduce inequalities (Bauer, 2014). For all these reasons, challenging categorical thinking in health inequalities research is important. The approach outlined in this paper offers an innovative and accessible way of doing so.

Appendix 5.1: Description of quantitative datasets

The quantitative analysis in this study is based on two geo-referenced datasets, linked together using Geographic Information Systems (GIS) in order to understand individuals' characteristics and health seeking behaviour, as well as their health service environment. The first dataset is the 2010 Service Availability and Readiness Assessment (SARA), which collected information on the location, staffing, infrastructure, and readiness to provide obstetric signal functions of health facilities. The sample is comprised of all facilities located in 17 out of Zambia's 72 districts, regardless of level or ownership. The districts were selected evenly but not randomly from across the country, although all of Zambia's 9 provinces are represented. Some districts were purposefully chosen in order to evaluate Global Fund activities, and malaria sentinel districts were also purposefully included. After excluding facilities without a valid geo-reference, or where the facility was revealed to be located outside a SARA district's shapefile, the final sample is composed of 596 health facilities.

The second dataset is the 2013-14 Zambia Demographic Health Survey, a nationally and regionally representative cross-sectional household survey. This survey collects information on socio-economic and demographic characteristics, attitudes and behaviour related to health and gender, and place of delivery for any births in the five years prior to interview, from women aged between 15 and 49 years. The two-stage sampling strategy is based on sampling clusters, which are comprised of an average of 130 households. For this study, only the sampling clusters located within the SARA dataset's 17 districts were included in the analytical sample. While the sampling clusters are geo-referenced, their exact location is "jittered" for confidentiality reasons. The location is randomly displaced by 0 to 2km for urban clusters and 0 to 5 km for rural clusters (of which 1% is displaced by 0-10km). The study sample is at the birth level, and includes all live births for which there is place of delivery information (19% of births that occurred in the five years prior to interview are missing this information), where the mother has not migrated since the birth, and where the birth was a singleton birth. The final sample (with no missing values on any variable) is composed of 248 sampling clusters and 2,963 live births.

Appendix 5.2: Variable selection, descriptive statistics, OLS regression

Health service environment variables

The affordability, cognitive, and psychosocial barriers could not be directly measured at the intersection of population needs and the health system. Instead, they are measured here according to characteristics that are discriminated against (or not accommodated) in the Zambian health system. For example, while user fees have been eliminated, the cost of delivering in a health facility remains high compared to average incomes because of the cost of transport and materials (clothes, nappies, cord clamps, plastic sheet and bucket, disinfectant, etc) (Kaiser et al., 2019b). Similarly, the KIIs and literature review confirmed that women with birth orders of two and above were more likely to believe that they were not at risk of obstetric complications, which is a misconception (Mulenga et al., 2018). Women with birth orders of six and above are likely to be discriminated against by nurses and midwives who judge them negatively for their high fertility (Paper 3, this thesis).

Importantly, these "barriers" are interpreted as institutional discrimination, either explicit, in the case of psychosocial barrier, or implicit, for the affordability and cognitive barriers. For this reason, "removing" the affordability, cognitive and psychosocial barriers does not imply making people richer or reducing their fertility, but rather creating a health service environment where wealth or birth order

are not a factor of social exclusion. In practice, this could mean ensuring that all necessary materials for giving birth are provided to birthing women by the healthcare system; creating programmes to subsidise the cost of transport to the facility; effectively communicating to women through community-based channels that while complications are indeed less likely for multi-parous mothers, life-threatening complications can occur at any parity; and providing education, supportive supervision, and management to health workers that succeeds in protecting all women's right to respectful healthcare, regardless of their social position or circumstances.

The geographic, availability and quality of care barriers were defined according to a straight-line distance of 10km. While the policy relevant distance is set at 5km in Zambian health strategy documents, the random displacement of DHS sampling clusters means that a distance of 10km is recommended in order to minimise misclassification errors (Burgert and Prosnitz, 2014; Wang et al., 2015). By construction, women facing the geographic barrier will also face the availability and perceived quality of care barriers, and women facing the availability barrier also face the perceived quality of care barrier. Similarly, any woman facing the psychosocial barrier will also face the cognitive barrier. Further information and justification of these variables is available from Paper 1 of this thesis.

Individual and household attributes

Marital status and professional occupation were initially included in models in their most detailed form, and then summarised according to the data-driven clustering of categories (married versus not; agricultural occupation versus not working versus all other occupations).

The autonomy variables were included at the DHS sampling cluster level in order to keep non-married respondents in the sample, as this variable is not available at the individual level for the non-married (the results do not change substantially for the married sample between the community vs. individual-level variable). The variable is based on the following question, asked to married women: "Who usually makes decisions about health care for yourself: you, your (husband/partner), you and your (husband/partner) jointly, or someone else?". Two variables are constructed: one is the average share of married women at the DHS sampling cluster level who say "husband decides alone". The other is the average share of married women at the DHS sampling cluster level who say "I decide alone". The "omitted" category is the average share of married women at the DHS sampling cluster level who say "husband and wife decide together". Less than 0.5% of the sample answered "someone else" or "other".

Table A5.1: Descriptive statistics, Zambia 2013-14

Variable	Obs	Mean	Std. Dev.	Min	Max
Facility delivery	2,963	74%	0.44	0	1
Poor (& affordability barrier)	2,963	43%	0.49	0	1
More educated	2,960	34%	0.47	0	1
Urban	2,963	40%	0.49	0	1
Cognitive barrier	2,963	81%	0.39	0	1
Psychosocial barrier	2,963	25%	0.43	0	1
Geographic barrier	2,963	21%	0.41	0	1
Availability barrier	2,963	38%	0.49	0	1
Quality of care barrier	2,963	57%	0.50	0	1
Community share of wives who say husband decides their healthcare	2,963	33%	0.25	0	1
Community share of wives who decide by themselves on own healthcare	2,963	24%	0.23	0	0.93
Literate	2,963	45%	0.50	0	1
Age at birth	2,963	27.04	6.89	13	47
More than one woman of reproductive age in the HH	2,963	31%	0.46	0	1
Married	2,963	81%	0.39	0	1
Not working	2,963	38%	0.48	0	1
Farm work	2,963	36%	0.48	0	1

Note: The data is not weighted

Table A5.2: Linear probability regression (OLS) of facility delivery on health service environment and individual, household and community attributes, Zambia 2013-14

	Coef.	Robust Std. Err.	t statistic	P value	[95% Conf. Interval]	
Affordability barrier	-0.070	0.027	-2.630	0.009	-0.122	-0.017
Cognitive barrier	-0.073	0.019	-3.870	0.000	-0.110	-0.036
Psychosocial barrier	-0.062	0.027	-2.320	0.021	-0.115	-0.009
Geographic barrier	-0.195	0.056	-3.460	0.001	-0.305	-0.084
Availability barrier	-0.093	0.051	-1.820	0.071	-0.193	0.008
Quality of care barrier	-0.075	0.033	-2.300	0.022	-0.140	-0.011
Community share of wives who decide by themselves on own healthcare	0.022	0.055	0.390	0.694	-0.087	0.130
Community share of wives who say husband decides their healthcare	0.112	0.064	1.740	0.083	-0.015	0.238
Literate	0.059	0.017	3.430	0.001	0.025	0.094
Age at birth	-0.001	0.002	-0.580	0.563	-0.005	0.003
More than one woman of reproductive age in HH	0.019	0.017	1.100	0.272	-0.015	0.053
Married	0.021	0.021	1.030	0.302	-0.019	0.062
Not working	-0.045	0.017	-2.620	0.009	-0.080	-0.011
Farm work	-0.083	0.029	-2.830	0.005	-0.141	-0.025
_cons	0.952	0.059	16.000	0.000	0.835	1.069

Appendix 5.3: Kitagawa-Oaxaca-Blinder decomposition

Kitagawa-Oaxaca-Blinder (K-O-B) decomposition is used to understand the extent to which maternal healthcare inequality is driven by the fact that different groups are differentially likely to face barriers (the "explained" or "levels" part) or by the fact that the effect of barriers on facility delivery differs in more advantaged versus less advantaged groups (the "unexplained" or "effects" part). This is left unexplored by other decomposition methods such as concentration index decomposition, which assumes that the effect of the contributory factors (x_k) on facility delivery are equal across groups. Unlike concentration index decomposition, K-O-B decomposition can only explain differences between two groups instead of the whole distribution.

Following Jann (2008), I define two models of healthcare access, one for the privileged SES category (A group) and another for the disadvantaged SES category (B group), with reference to the same vector of explanatory variables, X.

$$y_A = \alpha + X'_A\beta_A + \varepsilon_A$$

$$y_B = \alpha + X'_B\beta_B + \varepsilon_B$$

The difference between the mean of y_A and the mean of y_B , R, can be decomposed as follows:

$$R = [E(X_A) - E(X_B)]'\beta^* + [E(X_A)'(\beta_A - \beta^*) - E(X_B)'(\beta^* - \beta_B)]$$

The "levels" part of the inequality, $[E(X_A) - E(X_B)]'\beta^*$, is the part explained by the difference in mean Xs between the groups, evaluated according to a neutral or non-discriminatory coefficient

β^*, which is obtained from a pooled regression that includes both groups (and where group membership is included as a variable in the regression, as recommended by Jann (2008)).

The "effects" part of the inequality, $[E(X_A)'(\beta_A - \beta^*) - E(X_B)'(\beta^* - \beta_B)]$ is the part explained by the difference in coefficients between the groups, once more evaluated with respect to coefficients from a pooled regression, β^*. This interpretation is only valid if we assume there are no omitted variables. Otherwise, the difference in coefficients could be picking up differences in means of relevant explanatory variables that were not included in the model.

The K-O-B decomposition is implemented in Stata using the *oaxaca* command with the *pooled* and *vce(cluster)* options, the latter which estimates standard errors that account for clustering by DHS sampling cluster. While we can meaningfully ask which predictors contribute most to the "levels" part, this cannot easily be done with the "effects" part, because the results are not invariant to the choice of scale.

Due to the fact that detailed decomposition is more difficult in the context of a logistic regression (because it is hard to separate out the contribution of the endowments from the coefficients in a non-linear model), I use a linear probability model.

Analyses in this study are not weighted. This is partly because the sample of the DHS used for this study, a non-random sample of districts from all provinces, is not statistically representative of the country (or at the district-level). Weighting would therefore not result in statistically representative findings. Secondly, the study has an analytic focus, with the aim to uncover relationships between variables, for which weighting is not required.

Appendix 5.4: Qualitative data collection

Ethical clearance for this study was obtained from the London School of Economics Ethics Committee [ref. 000576] and the University of Zambia Biomedical Research Ethics Committee [ref. 005-06-17]. The study used key informant interviews (KII) to assist with quantitative variable selection. The KIIs were carried out in July 2017 with 12 experts in Lusaka, from Government, academic, donor, and NGO backgrounds. In addition, in-depth interviews were conducted with women who had given birth in the past year. In this paper, the in-depth interview data are used to better understand the context-specific meaning of the socio-economic categories. 42 in-depth interviews were conducted in Bemba (one of the main Zambian languages) in May-June 2018 with women who had given birth in the previous year. Women were recruited from a mix of urban and rural infant clinics in a specific district in Zambia, purposefully selected to represent a wide range of socio-demographic characteristics. The fieldwork district includes the provincial capital but is predominantly rural, and is remote in relation to the national capital city. The interviews focused on women's own pregnancy and birth experiences, as well as what they thought about how women's pregnancy and birth experiences might be affected by their age, marital status, wealth, occupation, number of children, and rural-urban residence. The latter was explored through 8 vignettes, which briefly describe hypothetical women's stories, narrated by the interviewer, supported by illustrations painted by a local artist. Each interview focused on contrasting two different vignettes, asking the participant to explain how these two hypothetical women's pregnancy and birth experiences would likely differ. Further details on qualitative data collection are provided in Paper 3 and Chapter 6 of this thesis.

Figure A5.1: Qualitative data collection tools - Vignettes

Grace is 27, married, she keeps her aunt with her and she has five children; She participates in her Catholic church, she lives in a village, cannot read and she does not work – she depends on her husband who sells charcoal, she plans to be pregnant again this year.

Annabelle is a 39 year-old peasant farmer, she can't read or write and lives in a rural area. She has no proper use of her right hand. She got married late, and this is her first child. She is very active in the Pentecostal church.

Lucy lives in a rural area, she is 43, has five children, she went up to secondary school – she wanted to go college but couldn't afford it. She doesn't work but she is married. One of her parents deals in traditional medicine.

Aisha is 20, she dropped out at Grade 7, she's orphaned, doesn't work, and this is her third child; she lives in a peri-urban area. Each child has been from a different father, and she's not married. The fathers of her other children support her.

Angela is 19, this birth was her first child – she was not planning to get pregnant but her uncle impregnated her. She finished grade 12 and lives in Mansa Town. She's not married but she wants to open a restaurant to secure the future of her child and further her education.

Kathy is 24, lives in Mansa urban, and this was her first birth. She works as a standards officer in the education sector. She's not married – her pregnancy was from a classmate in college. Her parents live in Mansa.

Memory is a 25-year old accountant who lives in Mansa town; she got pregnant from her boyfriend. This is her second child. She has no plans of getting married again, because she was disappointed by her first marriage. She is HIV +.

Jane is 29 years old, dropped out of school in grade 9, she lives in an urban area, she is a divorcee and has five children, but her last birth is from a married man whose wife cannot conceive. She's a business lady.

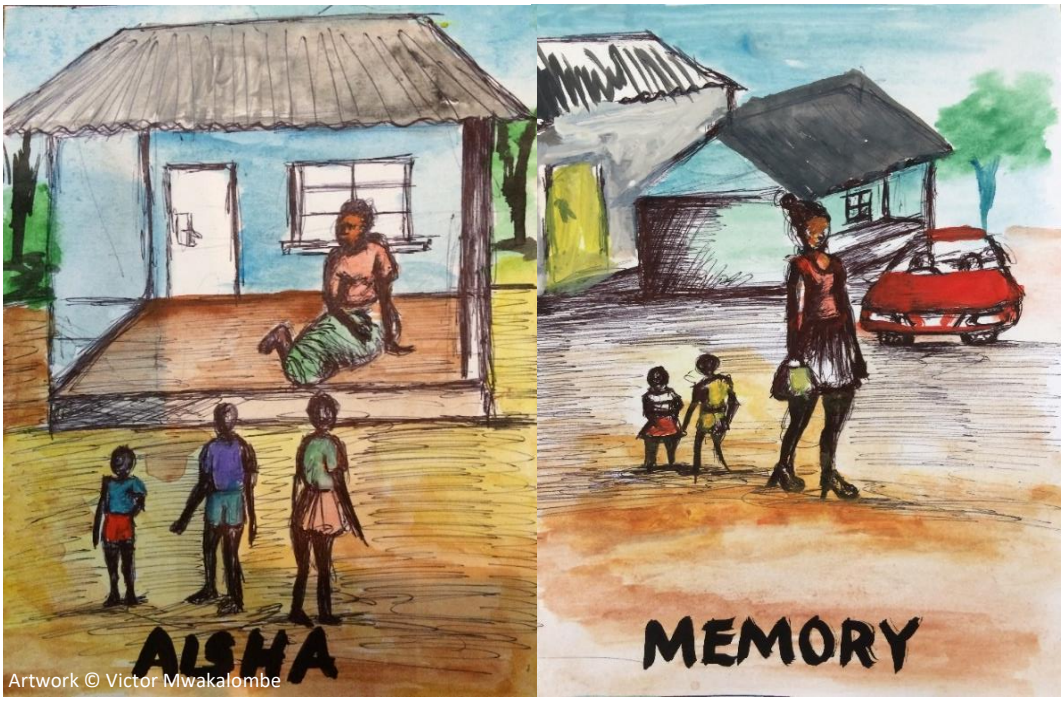


Figure A5.2: Qualitative data collection tools - In-depth interview guide extract

SECTION 4

Some women in pregnancy or childbirth might feel afraid, ashamed, angry or depressed. What kind of pregnancy or birth experience might make them feel this way?

Probe: aside from medical difficulties, what else?

What kind of women are most likely to have that experience [REFERRING TO ANSWER ABOVE]? What do people say about them?

You said _____X____ women were likely to have a bad birth experience. What if this woman was _____X____ and [*positive characteristic*], would she also be likely to have a bad birth experience? Why or why not?

SECTION 5

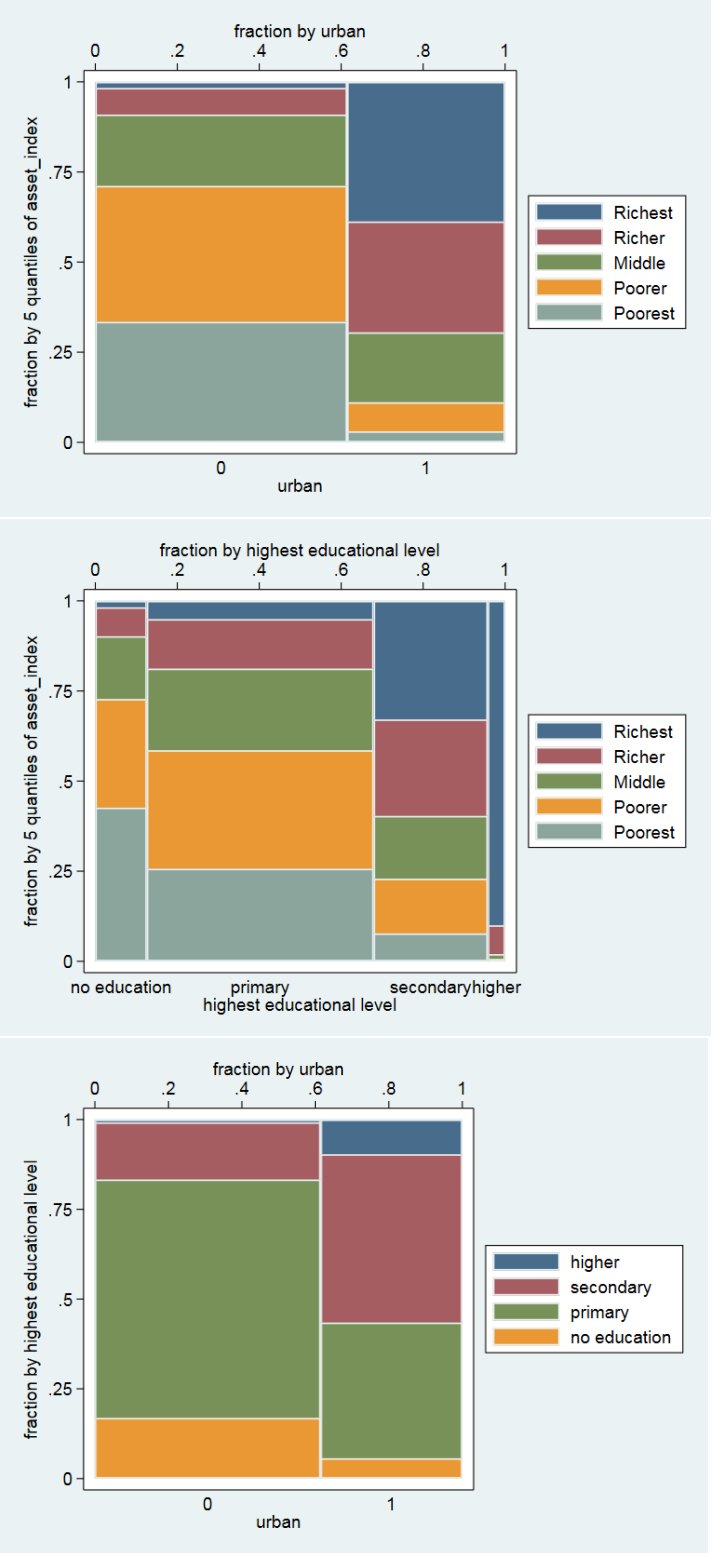
Now I am going to tell you some women's stories, and I would like you to imagine what sort of pregnancy and birth experiences they might have:

PICK TWO VIGNETTES AND READ THEM OUT

Who, of: **A** or **B** would be more likely to feel afraid, ashamed, angry or depressed in pregnancy or birth? Why?

What if **A** was _____? Would she have felt differently? How?
What if **B** was _____? Would she have felt differently? How?

Appendix 5.5: Distribution of the sample according to socio-economic dimension, Zambia 2013-14



Appendix 5.6: Levels of inequality by socio-economic dimension

When inequality levels are calculated according to binary variables, rural-urban inequality in access to facility delivery is the largest, followed by wealth inequality, followed by education inequality. When calculating inequality levels relative to the most "continuous" variable available for each dimension, the concentration index for wealth (and the Wagstaff and Erreygers indices, which are variations thereof) is higher than that for rural-urban residence, which is higher than that for education.

Table A5.3: Inequality levels in facility delivery by continuous and binary socio-economic dimensions (Zambia 2013-14)

	Mean differences	**Concentration Index**	**Wagstaff index**	**Erreygers index**
Continuous variables				
Travel time to city		-0.1068	-0.4028	-0.314
Wealth index		0.1138	0.4254	0.3334
Years of education		0.0872	0.3264	0.2556
Binary variables				
Urban vs. rural	0.32	0.105	0.3924	0.3075
Not poor vs. poor	0.25	0.0831	0.3108	0.2436
More vs. less educated	0.23	0.0672	0.2517	0.1971

Levels of inequality differ according to intersections between socio-economic dimensions (Table A5.4). Wealth and education inequalities in access to facility delivery are very low (or inexistent) for urban residents (0.02^{ns}; 0.06) and are larger for rural residents (0.09; 0.15). The poor and the less educated have larger urban-rural disparities than their more advantaged counterparts (0.33 vs. 0.26; 0.32 vs. 0.22). This indicates that urban residence is "protective" for poor and less educated women, while wealth and education are "protective" for rural residents. Conversely, wealth disparities in facility delivery are greater amongst the more educated (0.25 vs. 0.18), while education disparities are greater among those who are not poor (0.16 vs. 0.10). It appears that education (or wealth) only confers its full advantages if one is not poor (or uneducated). This makes sense from the perspective of the qualitative findings: being educated while being poor means that the potential of education has not been realised. Education, then, is "*just a piece of paper*". Similarly, there is a lot of diversity in the life experiences of those who are "not poor" (three wealth quintiles) – those with an education are much likely to have a more prestigious occupation, live in an urban area, etc.

Table A5.4: Differences in mean facility delivery by socio-economic dimension, Zambia 2013-14

	Overall	**Urban**	**Rural**	**Not poor**	**Poor**	**More educated**	**Less educated**
Urban-rural disparity	0.32			0.26	0.33	0.22	0.32
Rich-poor disparity	0.25	0.02^{ns}	0.09			0.25	0.18
Educated-less educated disparity	0.22	0.06	0.15	0.16	0.10		

Appendix 5.7. Full Kitagawa-Oaxaca-Blinder decomposition of SES inequalities in access to facility childbirth, Zambia 2013-14

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**
Overall									
Mean access high SES category	0.93	0.01	0.00	0.84	0.01	0.00	0.89	0.01	0.00
Mean access low SES category	0.61	0.02	0.00	0.59	0.03	0.00	0.66	0.02	0.00
Difference in mean access	0.32	0.03	0.00	0.25	0.03	0.00	0.23	0.02	0.00
"Levels" inequality	0.22	0.04	0.00	0.18	0.02	0.00	0.19	0.03	0.00
"Effects" inequality	0.10	0.03	0.00	0.07	0.03	0.01	0.04	0.03	0.21
Levels inequality									
Affordability barrier	0.03	0.02	0.08	NA	NA	NA	0.03	0.01	0.01
Cognitive barrier	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00
Psychosocial barrier	0.01	0.01	0.04	0.01	0.00	0.03	0.02	0.01	0.03
Geographic barrier	0.07	0.02	0.00	0.04	0.02	0.00	0.03	0.01	0.01
Availability barrier	0.05	0.03	0.09	0.04	0.02	0.07	0.03	0.01	0.08
Quality of care barrier	0.02	0.03	0.53	0.04	0.02	0.02	0.03	0.01	0.03
% of wives who decide by themselves	0.00	0.01	0.88	0.00	0.01	0.69	0.00	0.01	0.71
% of wives who say husband decides	-0.01	0.01	0.13	-0.01	0.01	0.10	-0.01	0.01	0.10
Literate	0.02	0.01	0.00	0.02	0.01	0.00	0.03	0.02	0.26
Age at birth	0.00	0.00	0.55	0.00	0.00	0.64	0.00	0.01	0.53
> 1 woman of reproductive age in HH	0.00	0.00	0.34	0.00	0.00	0.28	0.00	0.00	0.28
Married	0.00	0.00	0.25	0.00	0.00	0.36	0.00	0.00	0.31
Not working	-0.01	0.00	0.05	-0.01	0.00	0.02	0.00	0.00	0.04
Farm work	0.03	0.01	0.02	0.04	0.01	0.01	0.03	0.01	0.01
Effects inequality									

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**
Affordability barrier	0.01	0.01	0.16	NA	NA	NA	0.01	0.01	0.53
Cognitive barrier	0.05	0.03	0.08	0.02	0.03	0.53	0.03	0.03	0.27
Psychosocial barrier	-0.01	0.01	0.29	-0.03	0.01	0.08	-0.02	0.01	0.02
Geographic barrier	0.00	0.00	0.23	-0.01	0.02	0.38	-0.01	0.01	0.39
Availability barrier	0.01	0.01	0.28	-0.01	0.03	0.79	0.00	0.02	0.83
Quality of care barrier	0.02	0.03	0.54	0.03	0.04	0.45	0.02	0.02	0.42
% of wives who decide by themselves	-0.03	0.04	0.40	-0.05	0.04	0.23	-0.05	0.03	0.08
% of wives who say husband decides	-0.05	0.02	0.03	-0.07	0.03	0.02	-0.05	0.02	0.01
Literate	0.00	0.02	0.87	0.00	0.01	0.85	-0.03	0.03	0.26
Age at birth	0.24	0.09	0.01	0.30	0.11	0.01	0.20	0.08	0.02
# women of reproductive age in HH	-0.02	0.01	0.05	-0.01	0.01	0.24	-0.01	0.01	0.28
Married	-0.02	0.03	0.47	-0.02	0.04	0.57	-0.06	0.03	0.07
Not working	0.02	0.02	0.16	0.04	0.02	0.04	0.01	0.01	0.51
Farm work	0.02	0.01	0.11	0.01	0.03	0.69	0.00	0.01	0.88
_cons	-0.14	0.10	0.17	-0.14	0.12	0.24	0.00	0.09	0.97

Appendix 5.8: Underlying coefficients and levels in Kitagawa-Oaxaca-Blinder decomposition of SES inequalities in access to facility childbirth, Zambia 2013-14

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**
Coefficients: High SES category									
Affordability barrier	0.017	0.048	0.725	NA	NA	NA	-0.036	0.048	0.457
Cognitive barrier	-0.047	0.019	0.012	-0.065	0.020	0.001	-0.056	0.022	0.012
Psychosocial barrier	-0.050	0.024	0.039	-0.086	0.030	0.005	-0.126	0.044	0.004
Geographic barrier	-0.314	0.031	0.000	-0.252	0.069	0.000	-0.249	0.073	0.001
Availability barrier	0.106	0.049	0.031	-0.090	0.061	0.138	-0.073	0.058	0.213
Quality of care barrier	-0.039	0.042	0.352	-0.051	0.035	0.149	-0.056	0.034	0.102
% of wives who decide by themselves	-0.024	0.028	0.383	-0.033	0.033	0.304	-0.055	0.034	0.102
% of wives who say husband decides	-0.028	0.057	0.618	-0.004	0.060	0.944	-0.054	0.064	0.397
Literate	0.059	0.016	0.000	0.059	0.019	0.001	0.000	(omitted)	
Age at birth	0.004	0.002	0.018	0.003	0.002	0.073	0.004	0.002	0.039
> 1 woman of reproductive age in HH	-0.019	0.015	0.203	-0.002	0.018	0.914	-0.004	0.021	0.857
Married	0.004	0.017	0.811	0.001	0.019	0.952	-0.031	0.023	0.181
Not working	-0.015	0.017	0.377	-0.010	0.017	0.574	-0.029	0.020	0.135
Farm work	-0.003	0.043	0.948	-0.096	0.038	0.012	-0.074	0.046	0.111
_cons	0.851	0.048	0.000	0.880	0.055	0.000	0.977	0.052	0.000
Coefficients: Low SES category									
Affordability barrier	-0.061	0.031	0.052	NA	NA	NA	-0.074	0.031	0.015
Cognitive barrier	-0.111	0.031	0.000	-0.091	0.037	0.014	-0.094	0.028	0.001
Psychosocial barrier	-0.028	0.037	0.442	0.001	0.046	0.983	-0.027	0.032	0.396
Geographic barrier	-0.184	0.055	0.001	-0.172	0.067	0.010	-0.181	0.061	0.003

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**
Availability barrier	-0.097	0.053	0.070	-0.079	0.069	0.258	-0.091	0.058	0.117
Quality of care barrier	-0.042	0.048	0.383	-0.104	0.059	0.077	-0.090	0.042	0.032
% of wives who decide by themselves	0.089	0.121	0.463	0.123	0.140	0.380	0.078	0.081	0.332
% of wives who say husband decides	0.202	0.093	0.031	0.264	0.105	0.012	0.193	0.081	0.017
Literate	0.054	0.027	0.047	0.049	0.033	0.147	0.031	0.030	0.290
Age at birth	-0.005	0.003	0.083	-0.008	0.004	0.027	-0.004	0.003	0.145
> 1 woman of reproductive age in HH	0.041	0.028	0.142	0.047	0.037	0.206	0.033	0.026	0.199
Married	0.034	0.036	0.354	0.029	0.043	0.507	0.048	0.033	0.145
Not working	-0.071	0.038	0.061	-0.121	0.053	0.024	-0.049	0.027	0.067
Farm work	-0.103	0.041	0.013	-0.104	0.052	0.047	-0.084	0.036	0.020
_cons	0.993	0.092	0.000	1.020	0.110	0.000	0.981	0.080	0.000
Coefficients: Pooled model									
Affordability barrier	-0.049	0.028	0.081	NA	NA	NA	-0.069	0.027	0.009
Cognitive barrier	-0.073	0.019	0.000	-0.073	0.019	0.000	-0.070	0.019	0.000
Psychosocial barrier	-0.056	0.027	0.036	-0.062	0.027	0.020	-0.058	0.027	0.030
Geographic barrier	-0.195	0.056	0.000	-0.195	0.056	0.001	-0.194	0.056	0.001
Availability barrier	-0.087	0.051	0.084	-0.093	0.051	0.069	-0.091	0.051	0.074
Quality of care barrier	-0.022	0.035	0.534	-0.075	0.033	0.021	-0.073	0.032	0.025
% of wives who decide by themselves	0.008	0.056	0.879	0.022	0.055	0.693	0.020	0.055	0.710
% of wives who say husband decides	0.104	0.064	0.107	0.112	0.064	0.081	0.115	0.064	0.073
Literate	0.054	0.017	0.002	0.059	0.017	0.001	0.033	0.029	0.258
Age at birth	-0.001	0.002	0.541	-0.001	0.002	0.562	-0.001	0.002	0.529
> 1 woman of reproductive age in HH	0.016	0.017	0.330	0.019	0.017	0.269	0.019	0.017	0.270
Married	0.024	0.020	0.231	0.021	0.021	0.300	0.021	0.021	0.305

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	Robust SE	P value	Coef.	Robust SE	P value	Coef.	Robust SE	P value
Not working	-0.040	0.017	0.018	-0.045	0.017	0.009	-0.045	0.017	0.008
Farm work	-0.069	0.029	0.017	-0.083	0.029	0.005	-0.083	0.029	0.004
_cons	1.066	0.073	0.000	0.952	0.059	0.000	0.948	0.060	0.000
Levels: High SES category									
Affordability barrier	0.046	0.012	0.000	NA	NA	NA	0.166	0.022	0.000
Cognitive barrier	0.753	0.014	0.000	0.780	0.012	0.000	0.661	0.017	0.000
Psychosocial barrier	0.115	0.011	0.000	0.188	0.013	0.000	0.076	0.009	0.000
Geographic barrier	0.008	0.008	0.316	0.110	0.021	0.000	0.099	0.022	0.000
Availability barrier	0.019	0.014	0.157	0.193	0.027	0.000	0.194	0.028	0.000
Quality of care barrier	0.085	0.028	0.003	0.338	0.034	0.000	0.327	0.035	0.000
% of wives who decide by themselves	0.427	0.026	0.000	0.375	0.020	0.000	0.393	0.022	0.000
% of wives who say husband decides	0.159	0.018	0.000	0.190	0.015	0.000	0.187	0.015	0.000
Literate	0.657	0.025	0.000	0.599	0.020	0.000	1.000	.	.
Age at birth	26.364	0.244	0.000	26.925	0.213	0.000	25.219	0.253	0.000
> 1 woman of reproductive age in HH	0.403	0.019	0.000	0.379	0.016	0.000	0.416	0.020	0.000
Married	0.761	0.015	0.000	0.797	0.012	0.000	0.722	0.016	0.000
Not working	0.454	0.023	0.000	0.444	0.019	0.000	0.435	0.022	0.000
Farm work	0.068	0.020	0.001	0.172	0.020	0.000	0.142	0.020	0.000
Levels: Low SES category									
Affordability barrier	0.683	0.023	0.000	NA	NA	NA	0.558	0.026	0.000
Cognitive barrier	0.849	0.009	0.000	0.850	0.011	0.000	0.887	0.008	0.000
Psychosocial barrier	0.340	0.017	0.000	0.330	0.020	0.000	0.338	0.016	0.000
Geographic barrier	0.344	0.048	0.000	0.340	0.050	0.000	0.264	0.039	0.000
Availability barrier	0.627	0.047	0.000	0.635	0.048	0.000	0.476	0.042	0.000

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**	**Coef.**	**Robust SE**	**P value**
Quality of care barrier	0.895	0.031	0.000	0.877	0.031	0.000	0.690	0.035	0.000
% of wives who decide by themselves	0.259	0.020	0.000	0.262	0.021	0.000	0.293	0.018	0.000
% of wives who say husband decides	0.295	0.022	0.000	0.307	0.023	0.000	0.266	0.019	0.000
Literate	0.305	0.019	0.000	0.242	0.017	0.000	0.163	0.013	0.000
Age at birth	27.501	0.256	0.000	27.197	0.304	0.000	27.979	0.238	0.000
> 1 woman of reproductive age in HH	0.240	0.016	0.000	0.207	0.019	0.000	0.250	0.015	0.000
Married	0.845	0.011	0.000	0.830	0.013	0.000	0.857	0.011	0.000
Not working	0.325	0.027	0.000	0.287	0.028	0.000	0.347	0.023	0.000
Farm work	0.551	0.031	0.000	0.603	0.031	0.000	0.466	0.029	0.000

Chapter 6: Behind the scenes

Table of Contents

This chapter explains the choice of qualitative and quantitative methods used in the thesis, reflects on the mixedness of methods, and describes the process through which they were discarded or selected, as well as the challenges overcome in applying them. The chapter then presents the ethical issues encountered over the course of the research and reflects on my positionality as a researcher.

1. Mixed methods for health inequalities research

This thesis applies a range of quantitative and qualitative methods, combining them to shed new light on familiar datasets and a well-researched topic. In order to adequately explore the role of context in explaining maternal healthcare inequalities, I use GIS methods to link population-level data and facility-level data, and key informant interviews to inform the selection of quantitative variables. I also apply Bayesian multilevel models to explicitly model the importance of context relative to individual-level heterogeneity – or, reframed in a more sociological perspective, social structure versus agency. The thesis also explores whether policies, context, and individual attributes have heterogeneous effects on facility delivery and the experience of pregnancy and birth. To this end, I use Kitagawa-Oaxaca-Blinder decomposition and interaction terms in the quantitative analysis, and in-depth interviews supported by vignettes in the qualitative analysis.

1.1. Mixing quantitative and qualitative methods

This thesis combines quantitative and qualitive methods in different ways. In Paper 1, 2, and 4, I use key information interviews to validate the conceptual framework of accessibility underlying the quantitative analyses and to select appropriate quantitative variables for each of the accessibility

dimensions (Section 1.2). I aimed to maximise the validity of these variables in the specific context of Zambia, and to draw on context-specific expertise to map relevant, high-quality data sources. The variables chosen for each of the accessibility dimensions are specific to Zambia. Here, qualitative methods are used "to increase the validity of constructs and [quantitative] inquiry results by capitalizing on inherent method strengths"(Greene et al., 1989).

Paper 3 draws on in-depth interviews with women who gave birth in the previous year in a specific Zambian district. Its contribution lies in being able to explore an analytical object which lends itself uniquely well to qualitative analysis and is difficult to investigate using quantitative analysis. Rather than inequalities in access to facility delivery, which is the focus of the quantitative papers, it investigates inequities in the experience of pregnancy and childbirth. This perspective is valuable because it highlights inequities that matter in women's lives, and yet remain hidden by an exclusive focus on healthcare access.

This in-depth interview data is also used in Paper 4 to understand the context-specific meaning of three dimensions of socio-economic status that are quantitatively measured and analysed in that paper: wealth and poverty, education, and rural-urban residence. It is also exploited to interpret Paper 4's quantitative results. Since the qualitative data was collected in a specific district of Zambia and five years later than the quantitative data, other Zambian studies are also referenced to ensure that the interpretation is relevant to Zambia more broadly. The in-depth interview data was collected prior to the quantitative analysis for Paper 4, such that the results of the quantitative analysis could not be used to influence the process of qualitative data collection.

1.2. Key Informant Interviews

Key informant interviews (KIIs) were used to validate the healthcare accessibility framework (Chapter 1, Section 7.1), and to inform the selection of variables to measure each dimension. Including insights from key informants was important for three reasons. Firstly, it was important to select a single variable per dimension in order to avoid an exponential increase in the number of health service environments in Paper 1 and in the number of interaction analyses in Paper 2. The accessibility dimensions are very broad concepts, such that there is no single variable that can adequately measure them. Drawing on the opinion of a group of experts is therefore very useful to improve the legitimacy of the selected variable. Secondly, the key informants were highly knowledgeable about the ways in which these accessibility dimensions operate in Zambia, and about the quality of different data sources, thus providing valuable technical input into the selection of variables. Thirdly, experts' different views contributed to my understanding of the advantages and disadvantages of the selected variables, aiding the interpretation of the results.

The KIIs were held in Lusaka between the 26th July and the 4th August 2017. Twelve interviews were conducted, with respondents from academic, government, international aid, and medical backgrounds, selected purposively for their knowledge of healthcare access in Zambia. A third of the respondents were producers as well as users of data, while the rest were solely users of data; all except one were Zambian nationals; a quarter were maternal health specialists while three quarters held more generalist knowledge around access to primary healthcare, of which maternal healthcare is a significant component (Table 1).

Table 1: Key informant characteristics (N=12)

Gender	Sector[26]	Seniority	Producer or user of data	Zambian	Maternal health specialist
25% Female	50% Government of Zambia	25% Low	33% Producer and user	92% Zambian	25% Yes
75% Male	50% Academic	8% Medium	67% User	8% non-Zambian	75% No
	42% Medical	67% High			
	25% International aid				

Following ethical clearance from the London School of Economics and the University of Zambia's Biomedical Research Ethics Committee (ref: 005-06-17), written informed consent was sought and obtained from all respondents. 9 out of 12 interviews were audio-recorded. During the interview, which lasted between 15 minutes and four hours (most lasted between 30 and 60 minutes), respondents were asked to comment on the conceptual framework and to identify any missing barriers that were not in the framework. Respondents who had a limited amount of time were asked to select a set of four accessibility dimensions they wanted to focus on. For each concept, they were asked to: select the variable they believed was most appropriate out of a set of variables I provided from prior research on available data (between 1 and 5 choices per concept); explain why it was a better measure than other variables; give a grade to all available variables between 0 and 10; and suggest any other variables that had not been part of the original set. Respondents were reminded that I was interested both in the variable's conceptual closeness to a given accessibility dimension, but also in the availability of high-quality data to measure this variable in the Zambian context. Respondents were also asked to identify the socio-demographic variables that might describe significant inequalities in facility delivery in Zambia, and to suggest sensible cut-off points for these in order to generate binary variables. The KII interview guide, information sheet and consent form are provided in Thesis Appendix 2. Quantitative scores given to variables were recorded in a table and contrasted across respondents (within accessibility dimensions). Qualitative statements made in the interviews were simultaneously coded and transcribed by typing them into matrix, with variables in columns and respondents in rows.

These interviews were for the most part elite interviews, with the respondents having more power than the interviewer, particularly for older male respondents. As a small example, the interviews were held in their offices, at a convenient time for them. Because of this dynamic, there was somewhat limited scope to address potential inconsistencies in respondents' answers, particularly when the interview was kept short due to respondents' busy schedule.

Several challenges were faced during the KIIs. It was difficult to encourage respondents to consider data quality and availability, even though they had this knowledge, as they preferred to select variables based on validity. As a result, several suggestions made were not feasible (e.g. linking cost data from a survey that was not geo-referenced). Respondents found it much easier to measure barriers from a health system perspective instead of the individual's perspective, as most of them were used to developing health system indicators for policy use. Many suggested indicators that could

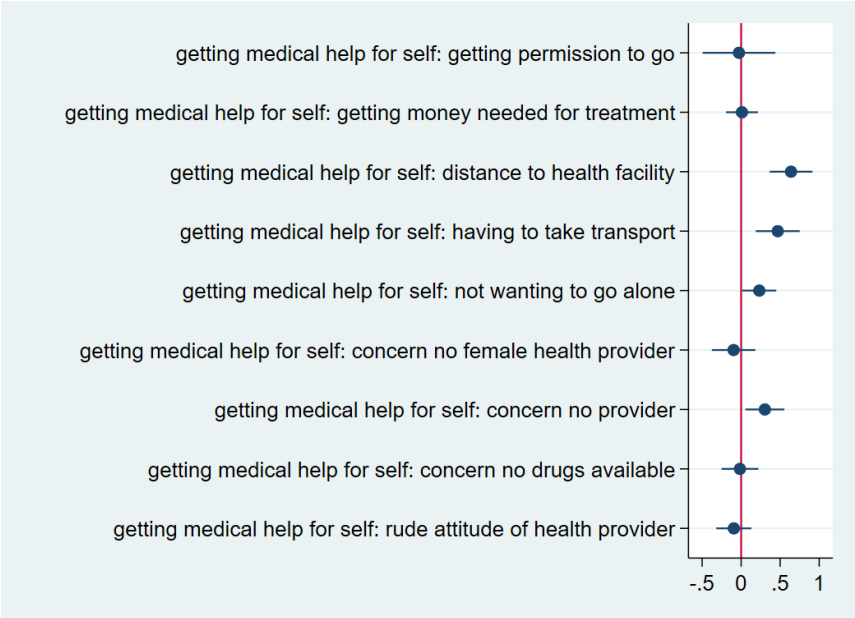
[26] These percentages do not add up to 100% as some key informants had more than one affiliation

only be used at an aggregate level, such as the share of population accessing skilled birth attendance. It was also challenging for busy respondents to fully engage in a complex methodology in what were sometimes short interviews.

1.3. Linking datasets via geographic information systems

I use Geographic Information System (GIS) methods to link population-level data (2013-14 DHS) to facility-level data (2010 SARA). The linking of the two datasets was done in ArcGIS and the process for doing so is explained in-depth in Thesis Appendix 1. This approach is better able to measure the health service environment compared to self-reported variables. For example, Moyer et al. (2013) analyse maternal healthcare access in Ghana using DHS variables that measure the types of problems women report when accessing healthcare for themselves when they are sick. However, these variables are not specific to maternal healthcare (and may in fact exclude maternal healthcare if women do not consider pregnancy or childbirth as a sickness), may be subject to social desirability bias, and may be more negatively reported by women who have actually sought care. In Zambia, significant coefficients on these variables are *positively* associated with facility delivery (Figure 1), which is counter-intuitive and demonstrates that these variables are not fit for purpose.

Figure 1: Coefficients from a multi-variable binomial logistic regression on whether the last birth took place in a health facility. Zambia DHS 2013-14



Note: Question asked: "When you are sick and want to get medical advice or treatment, is each of the following a big problem or not?"

In this thesis, I use straight-line distance instead of networked distance or impedance surfaces. In relatively flat regions of LMICs, using straight-line distance is a good proxy for actual travel time, particularly given the lack of information on modes of travel (Nesbitt et al., 2014). Zambia's national health strategic plans refer to targets maximising the share of the population within 5km of a health facility (Republic of Zambia Ministry of Health, 2017, 2011, 2009). Despite 5km being the policy-relevant distance, this thesis follows best practice by defining thresholds of access at the 10km level instead of the more policy-relevant 5km level in order to minimize classification errors (Burgert and Prosnitz, 2014; Matthews et al., 2019; Wang et al., 2015). DHS clusters' geo-references are randomly displaced in order to preserve anonymity. The rural clusters are displaced by 0-5km (with 1% displaced

up to 10km) while the urban clusters are displaced by 0-2km. This random jittering generates measurement error for the three dimensions of accessibility that are geographically defined. The direction of this bias cannot be predicted. Likewise, it is unclear whether rural or urban clusters will be more affected. While the maximum limit for the displacement of rural clusters is larger, the density of the service environment is much lower. Given the 10km barrier definition and the jittering "rules" (ignoring, for the sake of presentation, the 1% that can be displaced up to 10km), all rural clusters observed within 5km of any facility will be correctly classified as not facing the geographic barrier. All clusters observed further than 15km from any facility will be correctly classified as facing the geographic barrier. Clusters observed within 5 to 15km from any facility could be correctly classified, be a false positive, or be a false negative. For urban clusters, the same logic applies, except that the scope for potential misclassification is 8 to 12km.

1.4. Modelling context and individual heterogeneity using MAIHDA

In Paper 1, I use a multilevel approach, Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy (MAIHDA). MAIHDA has been developed by intersectional social epidemiologists such as Clare Evans and Juan Merlo in order to explicitly model the importance of social context, defined in this thesis as health service environments (Evans et al., 2017; Merlo, 2017). I define 24 health service environments, which I model as random intercepts. This allows me to parse out the variance in facility delivery *across* health service environments, versus *within* health service environments.

What distinguishes intersectional MAIHDA from the traditional use of random intercepts is the ability to refer to a social context that is both multidimensional and abstract. In the same way that intersectional scholars theorise the intersection of multiple social identities as an abstract but socially relevant context (Crenshaw, 1991), I heed Merlo et al.'s (2019) call to theorise and model context more flexibly by drawing on both geographic and social location to define health service environments. Public health researchers are used to thinking of geographic location as context. Individual characteristics, however, are typically framed as direct influences on health behaviour, rather than as characteristics that engender discrimination within a socially constructed system (Evans et al., 2017). Framing poverty and higher parities as social locations that are discriminated against within a health system counters this discourse to some extent. The qualitative analysis of in-depth interviews and key informant interviews conducted for this thesis, as well as other authors' studies referenced in the relevant papers, support this framing.

The other advantage of MAIHDA is that it can be used to measure the discriminatory accuracy of context thanks to the Intracluster Correlation Coefficient (ICC). This emphasis on predictiveness appears at first to be highly epidemiological (i.e.: how can we reliably identify people at risk of disease so we can target them with more interventions). I argue that in a progressive universalism approach, under which universal coverage is expanded by prioritising the worst off (Gwatkin and Ergo, 2011), there is much value from reliably identifying contexts with the lowest probability of access, as these can be prioritised for intervention. Methodologically, MAIHDA cannot tell us whether low access is causally explained by the health service environment, or in other words, whether improving the worst health service environments would improve the probability of access for the worse off. However, the assumption of causality can be strengthened by including control variables and another measure of context, community, as a cross-classified random intercept (operationalised in Paper 1 using DHS sampling clusters). Another feature indicating that poor health service environments may be the *cause* of low access is that health systems with more barriers predict lower access than health systems with

fewer barriers. If this association is spurious, there would have to be one or more omitted variables that exactly map onto this pattern.

MAIHDA is implemented, in this thesis and in other authors' studies, as a Bayesian model. The main reason for this is that, in my paper, the sensitivity analyses require a binomial logistic regression with cross-classified random intercepts (one at the level of health service environments, the other at the level of the sampling cluster). In this situation, frequentist estimation of the variance components using Laplacian approximation with one integration point would be highly biased (Rabe-Hesketh and Skrondal, 2008).

1.5. Imputation of missing data and the road not taken

I initially explored the possibility of using Zambia's 2012 Health Facility List instead of the 2010 Service Availability and Readiness Assessment (SARA) as the reference dataset for health facilities. The 2012 Facility List covers all facilities in Zambia, instead of only those facilities in the 17 districts sampled by the SARA. However, the 2012 Facility List does not have information on staffing or quality care. In order to use the 2012 Health Facility List, I had to impute this information based on health facilities that were surveyed in both the 2012 Facility List and the 2010 SARA dataset. This process involved:

(1) Matching the facilities in the 2012 Facility List to geo-references from 2016 and 2006.

While the 2012 Facility List was not itself geo-referenced, geo-references were available for the 2006 and the 2016 health facility censuses (the 2006 and 2016 censuses could not be used directly because they were too far in time from the 2008-2013 DHS period). These geo-references were merged into the 2012 list according to: health facility name, level, ownership, and district, with priority given to the 2016 geo-references. Where an exact merge was not possible (for example because of differences in spelling or an upgrade in the level of the health facility over time), an approximate match was made. This matching process was carried out by first establishing a subset of highly probable matches using the user written command for Stata, *matchit*. Then, the best match was selected manually from this subset, based on facility name. The 2012 list contained 1958 facilities; 1719 of these could be matched to valid 2006 or 2016 geo-references. The final sample of 1708 facilities was comprised of facilities without missing values on any of the covariates used in the imputation, described below.

(2) Matching the facilities in the 2012 Facility List to the facilities in the 2010 SARA.

The SARA collected data on 563 facilities. 441 of these could be merged or matched with the 2012 Facility List, using the same methods described in step 1.

(3) Imputing information on staffing and the capacity to deliver emergency obstetric signal functions for those facilities not included in the SARA, using a Bayesian imputation model.

After matching the 2010 SARA facilities to the facilities from the 2012 Health Facility List, 74% of (2012 Facility List) facilities had missing data on "CEMONC", 82% of facilities had missing data on "any midwife", and 74% had missing data for both variables. The imputation, which predicted values where they were missing, while accounting for the statistical uncertainty of the prediction, was carried out as part of the Bayesian model. This enabled me to simultaneously carry out the analysis of interest with the imputation, meaning that the outcome variable (facility delivery) could help predict the missing covariates, through the Bayesian feedback mechanism.

The two missing variables, "any midwife" (availability) and "CEMONC" (perceived quality of care) were each modelled using a Bernouilli distribution and a logistic link function, with their own set of

covariates taken from the 2012 Health Facility List. Selection of the covariates proceeded by minimising the Akaike Information Criterion and 6-fold cross-validation prediction errors, a method of model selection best suited to predictive models (Shmueli, 2011). As recommended in the literature, a variable predicting missingness was included for both predictive models: whether the facility's district was one of the 17 SARA districts. Other predictors included, for "CEMONC": facility type as dummy variables and whether the health facility owned a radio; for "any midwife": a dummy variable for each of seven selected districts, whether the facility had a telephone, piped water, any cots, facility type as a continuous variable, and whether it was recorded as a birthing site.

I chose to drop the imputation model, and to carry on with the SARA data instead of the 2012 Health Facility List. The cost of this was a much smaller analytical sample: 3,470 births instead of 11,240, restricted to 17 districts out of Zambia's 72. One reason for choosing not to impute was the extreme complexity of the Bayesian model, which was very slow as a result (at least five days, depending on the model). This inhibited iteration and learning, as well as the conduct of multiple sensitivity analyses. A second reason is that it is not clear how reliable it is to impute over 75% of values on two key variables.

1.6. Iterating methods to capture heterogeneous effects

A key aspect of the thesis' treatment of heterogeneous effects is the formulation and testing of the Concurrent Barrier Hypothesis (CBH). The most important part of testing CBH is to evaluate whether the strength of the association between a given barrier and facility delivery depends on the number of other barriers faced (CBH Condition 3). Two other approaches were considered before adopting the paper's chosen method.

The first method considered for the test of CBH Condition 3 was intersectional MAIHDA. In this method, evidence of intersectionality is provided by the variance of the health service environment random intercepts (or the ICC) remaining important after all the dimensions of the health service environment (i.e. six dummy variables, one per accessibility dimension) are included in the fixed part of the model. Doing so accounts for the additive effects of the health service environment, leaving only the intersectional (multiplicative) effects in the random intercepts. This method answers the question: Do births nested in specific health service environments have a significantly different probability of facility delivery compared to what would be expected solely from the additive effects of the healthcare access barriers that constitute those environments (Evans, 2019b)?

MAIHDA has many advantages, including better safeguards against multiple testing and higher efficiency in estimating many intersections, even when the sample within each intersection is small (Bell et al., 2019). When comparing the use of interactions terms to intersectional MAIHDA, Evans (2019b) finds that MAIHDA is less likely to find evidence of intersectional effects. The most likely reason for this is that the reference point for the assessment of the heterogeneous effects is different in MAIHDA compared to an interaction term approach. When an interaction term between the affordability barrier and the geographic barrier is specified, the main effect for the affordability barrier represents people who face an affordability barrier but no geographic barrier. Similarly, the main effect for the geographic barrier is the effect for people who face the geographic barrier but not the affordability barrier. In contrast, the main effects for the geographic barrier and the affordability barrier in MAIHDA represent the average, additive effects for all those who face the geographic and affordability barriers respectively. Deviation from this "average" is a higher bar than deviation from the interaction's reference category (Evans, 2019b).

Interactions were selected above intersectional MAIHDA in order to test CBH because a "moderator approach" was a much better fit for the Hypothesis. The CBH's Condition 3 is: "*If those who benefit the most from a single barrier being removed are those facing fewer or no other barriers".* The emphasis here is on "contingent effects", i.e. where *"the effect of an independent variable on a dependent variable differs depending on the value of the moderator variable."* (Jaccard and Dodge, 2004). While there is no single moderating variable (since each barrier is both an independent variable and a moderating variable), the purpose of the analysis is to investigate whether the effect of barriers on facility delivery is modified by other barriers.

In the beginning stages of the analysis, all feasible interactions were specified between the healthcare access barriers: 11 two-way interactions and 6 three-way interactions. However, this approach had several disadvantages. Firstly, many interaction parameters had to be estimated and it was not clear that the sample was large enough to assess significance. Secondly, the analysis did not faithfully model CBH Condition 3. The question of interest is not: "Does the effect of a specific barrier depend on whether another specific barrier(s) is present or absent?", but rather "Does the effect of a specific barrier depend on the number of other barriers faced?". Given these considerations, the analysis was repeated with interactions between a specific barrier and the number of other barriers faced, with the number of other barriers specified as a categorical variable to allow for non-linearity.

1.7. Using Kitagawa-Oaxaca-Blinder decomposition to explore intersectionality

In Paper 4, I use Kitagawa-Oaxaca-Blinder (K-O-B) decomposition to analyse the contributions of differential exposure and differential effects across SES levels in explaining inequalities in facility delivery. While the technique was first developed by demographer Evelyn Kitagawa (1955), it is often incorrectly attributed to labour economists Ronald Oaxaca (1973) and Alan Blinder (1973). In the labour economics literature, this type of decomposition is used to explain wage differentials between male and female and between Black and White workers. This application includes "official" determinants of wages, such as professional experience and education, into the model as explanatory variables (labelled as the "explained" part of the inequality). The differential effect of these determinants on wages across male and female groups (labelled as the "unexplained" part), is identified as labour market discrimination. In this thesis, I use K-O-B as an intersectional approach, to enquire whether the model's explanatory variables have different meanings for facility delivery across different levels of SES. While K-O-B is further explained elsewhere (Chapter 5, Appendix 5.3), the way in which K-O-B yields intersectional insights is by regressing facility delivery on explanatory variables in separate low vs. high SES samples (similar though not equivalent to an interaction between these variables and SES).

1.8. Exploring inequalities and heterogeneity qualitatively

It was challenging to design an in-depth interview study to explore inequalities. Exploring differences in women's experiences would require me to either compare women's experiences at the analytical stage (requiring diverse recruitment and a sufficient number of women in each analytical category); ask women about how they thought their experience compared with others (with the problem that they might not be aware of their relative privilege or disadvantage); or ask women to compare the likely experiences of third-parties (which they may not be familiar with). Originally, the interview guide combined all three perspectives, but dropped the second approach after pilot testing – asking women to compare their own experience to that of others – because this question was not eliciting pertinent responses for the study.

The first approach was implemented by recruiting a diverse sample out of the 20-50 women who came to the immunisation clinic daily. Recruitment was structured according to the characteristics anticipated from the literature and key informant interviews to be associated with inequalities in healthcare access and in the experience of maternal healthcare: age, marital status, education, parity, rural vs. urban residence, and socio-economic status. To facilitate comparisons, each interview was categorised according to the respondent's characteristics collected at the time of interview. Analytical memos looked for differences in coded content between categories, e.g. "married" vs. "not married".

To implement the third approach, part of the in-depth interview guide collected respondents' views regarding which types of women were more likely to have negative pregnancy and birth experiences, in an open question format (Figure 2).

Figure 2: Extract 1 from in-depth interview guide, June 2018

SECTION 5

Some women in pregnancy or childbirth might feel **afraid, ashamed, angry or depressed**. What kind of pregnancy or birth experience might make them feel this way?

- Probe: aside from medical difficulties, what else?

What kind of women are most likely to have that experience [REFERRING TO ANSWER ABOVE]? What do people say about them?

You said _____X____ women were likely to have a bad birth experience. What if this woman was _____X____ **and** [*positive characteristic*], would she also be likely to have a bad birth experience? Why or why not?

In addition, a more structured comparison was set up using eight vignettes that combined verbal and visual descriptions of women with different life stories (the vignettes' artwork was commissioned from a local artist, Victor Mwakalombe) (Figure 3 & Figure 4). The visual aides were provided in order to help respondents remember the details of the vignettes' stories. In each interview, two vignettes, chosen at random, were chosen to elicit respondents' thoughts about differences in women's pregnancy and birth experiences. The text of the vignettes was developed by four research assistants (RAs) during a five-day training workshop, based on 8 different combinations of socio-demographic characteristics I provided. The RAs were tasked with writing a short life story for each of these 8 hypothetical women that would make sense in the local context. The quality of the response to the vignettes differed widely. While it provided helpful anchoring for some respondents, other respondents focused on the fact that the pain of childbirth was the same for all women.

Figure 3: Extract 2 from in-depth interview guide, June 2018

SECTION 6

Now I am going to tell you some women's stories, and I would like you to imagine what sort of pregnancy and birth experiences they might have:

PICK TWO VIGNETTES AND READ THEM OUT

Who, of : **A** or **B** would be more likely to feel afraid, ashamed, angry or depressed in pregnancy or birth? Why?

What if **A** was _____? Would she have felt differently? How?
What if **B** was _____? Would she have felt differently? How?

The recruitment, interview guide and the content of the vignettes were designed to enable inter-categorical intersectional comparisons rather than simple heterogeneity: e.g. comparing older mothers in rural vs. urban settings, or unmarried women who have high vs. low levels of education. Qualitative intersectional studies typically conduct *intra*-categorical analysis, where a neglected point of intersection is investigated in depth, or inter-categorical analysis on a much smaller scale, for example examining the intersection between a maximum of two identities (Choo and Ferree, 2010). My research approach made an inter-categorical intersectional approach with the full range of relevant socio-demographic characteristics unfeasible in practice. Nevertheless, important intersectional insights did come through independently of an inter-categorical analytical approach, such as how gender fundamentally shapes material inequalities, made in Paper 4.

Figure 4: Poster by the author on the topic of vignettes, OXO Tower LSE Social Policy Exhibition, January 2019

2. Ethics & positionality

This section reflects on the ethical issues encountered in the process of collecting in-depth interview data, and on how my own social position, as well as that of the two interviewers I employed, influenced data collection and analysis. The section ends by describing the impact that my professional and academic background has had on the framing of the thesis as a whole.

2.1. My role in the in-depth interview data collection

While I conducted the key informant interviews myself, in-depth interviews were led by two Zambian female interviewers, mainly in the Bemba language or more rarely in English, depending on the preference of the respondent. One interviewer was in her 50s, had extensive experience of conducting qualitative interviews for health programme evaluations, and did not have a university education. The other interviewer was in her 20s, a graduate in Zambian Cultural Studies with some experience of qualitative interviewing. I recruited the two interviewers in Lusaka from a large pool of qualified applicants and conducted a five-day workshop with them, covering the purpose of the study, ethical interviewing, recruitment of respondents, sense-checking and improving the interview guide, translation of the interview guide to Bemba, interviewing role-play, and pilot interviews.

Early on, we encountered potential respondents who were not comfortable with my presence in the interview. As a result, I was only present for two interviews with women who explicitly gave their consent to my presence. Instead, I usually observed the workings of the immunisation clinic itself, taking note of my observations and of my interactions with health workers who spoke English. I also took notes on informal conversations (not recorded) with two district health officers and one senior health worker at the Provincial Hospital. A daily debrief session was carried out as a team, where we discussed the day's interviews in terms of content and logistics, and established what questions had worked well or not, which fed into the progressive iteration of the interview guide.

2.2. Data in translation

The interview recordings in Bemba were directly transcribed into English by the two interviewers and two additional research assistants. The latter carried out a quarter of the transcriptions, which were reviewed by the original interviewer. As a result of the translation, the words used in analysis, including in the formulation of the rules, were heavily influenced by the transcribers. In order to manage this limitation, the translation and transcription were carried out within one month of conducting the interview. The rationale for this was to enable sufficient recall of the interview situation and non-verbal clues in order to infer meaning behind words. Transcribers worked together to agree on coherent translations and were instructed to translate expressions as literally as possible without substituting English-language expressions, in order to limit the amount of interpretive meaning-making. Instead, interpretation was jointly practiced. I re-read all transcripts as they were produced and asked interviewers to suggest multiple meanings and connotations where there was potential ambiguity or where the English translation was not intelligible.

2.3. Consent process for in-depth interviews

Written or oral informed consent was obtained for all interviews, according to the preference of the respondent. The information sheet was summarised orally for the respondent, stressing anonymity and confidentiality, and the consent form was read out fully. Both were written in plain language, with Bemba and English versions available. Respondents could take an information sheet and a copy of the consent form home with them, which included contact details in case respondents

wanted to retract their participation. The consent form and information sheet are provided in Thesis Appendix 3.

During the consent process, we stressed that we were not working with the health facility but that the health workers and the Ministry of Health were aware of our presence, and that we would communicate our findings to the ministry. We also explained that the respondent could stop the interview at any time, and that they would not directly benefit from participating in the study. After the interview was over, we gave women a babygro and a chitenge to thank them for their time. Ethical clearance for this study was obtained from the London School of Economics Ethics Committee [ref. 000576] and the University of Zambia Biomedical Research Ethics Committee [ref. 005-06-17], and authorisation to the conduct the study was obtained from the Zambia Ministry of Health and the Mansa District Health Office.

At the end of the data collection, a reflexivity exercise[27] with the interviewers (as well as the original in-depth interview transcripts) provided some evidence that the consent process was - at times - complicated. For example, some respondents believed that the interviewers were health workers (for example, addressing them as "nurse"), and that I was a Peace Corps volunteer (particularly in more remote rural locations), despite the consent process stating the contrary. The conflation between our research and the health system was not altogether surprising since we were "hosted" by the urban and rural health centres, conducting the interviews within the perimeter of the health centre, at the same time as the infant immunisation clinics. Women waiting for the clinic to start would have seen us arrive and greet the health workers upon arrival, or seen us give health workers a lift in the case of outreach clinics. Some women were uncomfortable admitting that they could not sign the consent form, even though we presented the option for a thumb print upfront. Others expected financial help (for themselves or for the clinic) to come from the interview, even though the consent form explicitly stated the opposite. One of the interviewers felt that the consent process worked against building rapport: "*I think the formalities at first made them uncomfortable – made it seem like a formal interview.*"

2.4. Confidentiality

Interviews were held within the health centre's compound, or close to the outreach location. Initially, we attempted to hold interviews in a room inside the health centre, where available, but quickly discovered that these interviews were constantly interrupted by staff looking for items. We then decided to hold the interviews outside, with the rationale that it would at least confer aural, if not visual, privacy. Sometimes, even that was challenging, with respondents' friends coming to say hello, or passers-by walking close-by on a path. One of the interviewers reported that respondents were concerned that their friends could see them signing with a thumb print instead of signing their name on the consent form, implying that they were not literate.

All interviews were audio-recorded with respondents' consent and were directly transcribed from the Bemba audio recording into English by the interviewers and two additional research assistants. Transcripts were transferred to my own laptop using an encrypted USB and stored in an encrypted folder. Research assistants deleted the transcripts after transferring them. Names of people and

[27] Questions I asked during this exercise included: "How do you think the respondents would describe you to their friends?"; "Did any respondent ask you questions about yourself?"; "Who did you connect best with and why?"; "Who did you connect worst with and why?"; "What range of emotions did you feel during the interviews?"; "Do you think any of the respondents made the wrong decision?".

places were redacted in the quotes used in the papers and the respondents themselves are referred to with codes.

2.5. Ethical considerations

In addition to the ethical considerations reported above, several incidents are worth reporting here. In the first data collection site, I started by asking the nurse in-charge to help us select a diverse sample of respondents since he knew whether they were married or unmarried, how old they were, how financially vulnerable they were, and whether they had delivered in a health facility. However, I quickly realised that this was putting undue pressure on respondents to participate and did not replicate this. In a similar vein, we initially tried to purposefully include women who had not delivered in a health facility but realised that this led to overt pointing out and outright denial from the women concerned, evidently causing shame or fear of punishment. At the analysis stage, this became intelligible in the context of home deliveries being criminalised or highly stigmatised.

Another incident took place in a rural outreach clinic, which we realised upon arrival was only being held for our benefit, as the health workers had planned to cancel it. Because of the upcoming annual child health week, during which they are targets for the number of children immunised, the nurse in-charge refused to immunise the children on that day (despite my entreaties) but instead simply measured and weighed the infants. Realising that immunisations would not be given, the mothers could not choose to leave, since upon arrival, the child health cards (in which immunisations and anthropometric measurements are recorded) are taken and only redistributed at the very end, once every infant has been seen, which takes at least three hours. The health workers' rationale for this is to keep mothers on-site where they are given lectures about nutrition, hygiene, and family planning. Mothers and their children are expected to arrive promptly for the clinic, around 10am. On this day, they arrived only after hearing news from their neighbours that the health workers had arrived for the outreach clinic, which seems sensible given that outreach clinics can be cancelled if the staff is not available or if there are no vaccines. A male community health worker then proceeded to berate the assembled women for being late, in Bemba, pointing at me and implying that I was disappointed. While I attempted to deny this, by gesticulating and smiling, I doubt I was intelligible.

2.6. Positionality in data collection

A reflexivity exercise I organised with the interviewers after the data collection period shed light on the power dynamics between the two interviewers and the respondents. The interviewers reported that some respondents thought we had come to bring help or funding of some kind; others initially thought they were being singled out because they had done something wrong; that they were going to be asked difficult questions for which they had to prepare – perhaps about their biomedical knowledge of pregnancy and childbirth (which they are taught in antenatal clinics); or that I was going to interview them in English, another daunting prospect.

The relationship between the interviewers and the respondents was not the same across both interviewers, with one of the interviewer seemingly building better rapport overall. From her transcripts and the reflexiveness exercise, it is clear that she was more skilled at putting respondents at ease and guiding the interview while maintaining the sense of an open conversation: *"I got into the interviews, that's why I found it difficult to write, especially as we went on, they are telling me their story, maybe as if I am a close friend. Someone they've always known. In the beginning, it was very formal, but as we went on, it got personal."*

The power differential between respondent and interviewer is clearly expressed and felt by the other interviewer in the following quote: *"The child was crying, and I was emotional, I reduced myself*

*to her level; I wanted her to be free with me, that we were just the same even though some people would think she was down [*lower SES*]."* The first interviewer also expressed this difference, in a more self-reflective and critical way: *"The "Lusaka one" is key [*the fact that we told respondents we came from Lusaka*]. Lusaka is the biggest city so everyone thinks that if you are from Lusaka you know everything, you should be someone, you are doing fine in life, and to top it off, you've come with the white lady. That's why people were interested in participating – because they probably thought there was some special incentive."*

Some interviews were also affected by age differentials between interviewer and respondent, even though I assigned the younger respondents to the younger interviewer as a priority, and vice versa with the older respondents. The younger interviewer reported that she found only one older woman who was uncomfortable with her. The older interviewer spoke about one 18-year old respondent who was clearly scared in the beginning of the interview - "*maybe she thought she would get in trouble for this early marriages thing*". The interviewers also pointed out that age is not just a number – because she was married, the younger respondent said she would be described as a woman, not a young woman. Hierarchies of respect based on age were also disrupted by hierarchies based on status. The younger interviewer described how the respondents called her Madam (describes someone who works a formal job, usually a teacher), which was embarrassing when used by older respondents to whom she felt she owed respect.

The findings in Paper 3 clearly show strong moral arguments being made by respondents about their own and third parties' behaviour during pregnancy and childbirth. These moral judgements were also manifest in the interviewer-respondent relationship. In the reflexivity exercise, the interviewers felt that some respondents acted irresponsibly (e.g.: for marrying a violent man and then remarrying a man with mental health problems, for becoming pregnant); that rural respondents were insufficiently emotional when talking about their children dying; that they should not refer to their pregnancies as a mistake or to their husbands as "the husband"; that rural respondents had limited ambitions beyond getting married and having children. It is unclear the extent to which this was non-verbally communicated to respondents.

Overall, the relationship between interviewers and respondents, as well as my presence in the background, would, to some extent, have encouraged respondents to frame the rules as legitimate, and the rule breakers as immoral. It will also have likely discouraged some respondents from telling us that they did not follow some of the rules. It is also likely to have reinforced some of the stigma felt by low status respondents, or by respondents who had broken the rules, an unethical outcome. If I were to organise similar in-depth interviews in future, I would spend more time during the training period encouraging interviewers to reflect on their values and social position, and how that is likely to influence the interview relationship. More importantly, I would create space for this reflexive practice to continue throughout data collection, in order to notice and potentially correct behaviour that might be causing further stigma for the respondent. However, my position as an outsider who does not speak Bemba herself and does not understand social norms complicates my ability to grasp or oversee the interaction between interviewer and respondent. It would also make it impossible for me to recruit peer interviewers, who would be less likely to have hierarchical relationships with respondents, but with whom I would be unable to communicate. In conclusion, there is no shortcut out of the chain of power between me as the lead researcher and my respondents. Only learning the language and long-term embeddedness, in the style of ethnographic research, might have gone some way towards alleviating these epistemic and ethical problems. Conducting participatory research, and rectifying power imbalances that make it harder for Global South researchers to receive research funding and to publish, are important remedies to this problem (Valles, 2018; Walsh et al., 2016).

2.7. Positionality in the thesis

While it is obvious that qualitative data is co-created by the respondent and the researcher, and I have reflected on this process in sections 2.1 and 2.6 of this chapter, the rest of thesis, which uses mainly quantitative data and analysis, has also been shaped by my academic and professional background and my social position. I can articulate two specific instances (though there are doubtless many more). Both of these were brought to light through interdisciplinary engagement, without which I would have likely remained unaware of them.

The first point is that the thesis frames access to facility delivery as a problem of barriers – the assumption is that all women, under conditions of full accessibility, would choose to deliver in a health facility. This fundamental assumption underlies the vast majority of Global North-driven[28] public health research and programmes in the Global South, a research culture in which I have been professionally embedded since 2011. It is rooted in a biomedical perspective of childbirth, where the main goal of minimising the risk of lasting physical harm (biomedically understood) to the mother and the baby is assumed to be universally shared. This perspective also takes low levels of national resources as a given, which renders childbirth at home biomedically unsafe due to insufficient access to skilled midwives, a lack of ambulances and serviceable roads, and many homes' lack of access to electricity and clean water. As explained in Paper 4, the dominance of a biomedical approach to childbirth has been strongly influenced by colonial history and the subsequent international balance of power. The thesis' framing is also rooted in the rejection of cultural explanations of healthcare access, which have historically been used to essentialise difference (Spangler and Bloom, 2010). This framing of the thesis has been highlighted for me by sociologists of social inequalities on two separate occasions, once in a seminar at LSE, and once in a presentation at Sciences-Po Paris.

The second point is that the quantitative analysis seeks to explain maternal health inequalities by analysing data on women giving birth in Zambia. This level of analysis largely rules out the possibility of locating quantitative explanations in unequal power relations between countries, or between men and women. Including DHS data from different countries, or on the topic of the relationship between husbands and wives, would not be sufficient to conduct quantitative analysis highlighting these macro levels of explanation. This point was first brought to light by one of my colleagues, a feminist quantitative social scientist, and was further researched through intersectional feminist literature (Choo and Ferree, 2010; Connell, 2012). I reflect on this point further in Paper 4, and broadened paper 4's initial framing in response, using my own qualitative data and broader literature.

[28] By Global-North driven, I do not mean research conducted by Global North researchers, but rather the fact that this research and intervention agenda takes place in a system where financial resources, positions of power, and the history of the discipline or what it is acceptable to do are overwhelmingly controlled by people from the Global North.

Chapter 7: Conclusion

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Maternal health inequalities remain high, both between and within countries, yet we lack theoretically grounded, multi-level and multi-outcome research to explain these inequalities. Because *what* we choose to study and *how* has political and technical implications, developing alternative ways to research and explain maternal health inequalities can have important consequences for social justice. This thesis has developed novel ways to explain maternal health inequalities that specifically respond to these concerns and has reached innovative conclusions – for Zambia and for the field of maternal health – in the process. The thesis' analytical approach is grounded in multi-disciplinary theory, investigates different levels of social processes, and explores both maternal healthcare access and women's experiences of pregnancy and childbirth more broadly. The findings highlight the importance of context, particularly health service environments, and heterogeneous effects and meanings in explaining maternal health inequalities in Zambia. This chapter summarises the main findings from each of the four empirical chapters, outlines the main conceptual contributions of the thesis, and considers its implications for policy and further research.

1. Summary of findings

1.1. The importance of context

This thesis demonstrates the importance of context for explaining inequalities in health facility delivery in Zambia, and places the emphasis on an abstract, multidimensional, meso-level context: the "health service environment". This concept of the health service environment can be defined as the geographically and socially mediated accessibility of local health services for health users. Based on established conceptual frameworks of healthcare accessibility, I define six key dimensions that make up the health service environment, which I separate into geographically mediated dimensions (geographic accessibility, availability, and perceived quality of care) and socially mediated dimensions (affordability, cognitive accessibility, psychosocial accessibility). This conceptual framework, together with input from key informant interviews, informs the selection of explanatory variables for each of

the dimensions, which are operationalised in the empirical analysis as healthcare access "barriers". All feasible permutations of these barriers being present or absent result in the definition of 24 different health service environments.

In Paper 1, I find that health service environments are very predictive of access to facility delivery, with an Intra-Cluster Correlation Coefficient of 25%-27%, pointing to "fairly large" differences (Merlo et al., 2019) between levels of access across health service environments. This corresponds to an "Area under the receiver operating characteristic curve" (AUC) statistic of around 0.75, which measures the accuracy of health service environments for distinguishing between individuals with a low vs. average probability of access (the maximum level of the AUC is 1) (Merlo et al., 2019). This result changes little when including control variables made up of individual-level and terrain characteristics as well as a cross-classified random intercept at the DHS sampling cluster level, which controls for omitted variable bias at the community level. I estimate the predicted level of access per health service environment, in order to identify the most privileged environments relative to the most disadvantaged ones. I find that 91% of the sample face health system environments with at least one barrier, while 6% of the sample live in a health system environment where all six barriers are present. All births facing environments with four barriers or more have a predicted probability of facility delivery that is below average. With some exceptions, health service environments with more access barriers generally have a lower predicted probability of facility delivery, and the difference in the probability of access between environments with a different number of barriers is greater than the difference between environments with the same number of different barriers. Results also show that aspects of the health service environment linked to geographic location predict access more strongly than exclusion linked to women's social location.

Paper 2 uses the six healthcare access barriers (or accessibility dimensions) of the health service environment to investigate both the distribution of concurrent barriers according to socioeconomic status (SES), and interactions between barriers. I find that in the context of Zambia, women of lower SES, i.e. women in the bottom two wealth quintiles, women living in rural areas, and less educated women, face fewer healthcare access barriers on average, but that they are still likely to face some on average. While I present the findings on the interactions below, interactions between barriers support the idea that health service environments should be considered as a whole, i.e. as a multidimensional social context, rather than as disembodied barriers that are usually assumed to (and modeled as if they) operate independently from each other.

Paper 4 shows that health service environments explain a large share of socio-economic inequalities in facility birth in Zambia. Depending on the SES dimension, health service environments explain between 75 and 84% of "Levels" inequality in access to facility delivery. This paper also considers the macro-level context in addition to the meso-level context of health service environments. At the macro level, it demonstrates the importance of mutually modifying social processes, i.e. the intersecting influence of gender, class, and colonial/neo-colonial power relationships, in creating socio-economic inequalities in maternal healthcare access among women in Zambia. Gender relations play a key role in shaping maternal healthcare access inequalities by SES, because access to maternal healthcare requires some women to rely on men's financial and social support. These gender relations have themselves been influenced by colonial history. The insufficient public financing of health facilities is one of the reasons why individual financial resources are required for healthcare access, while the financing of the Zambian health sector cannot be divorced from global economic policies and politics. Finally, the meaning of facility delivery and the rules pertaining to it is strongly related to gendered and colonial ideas of what a respectable, modern Zambian woman is

understood to be, which also affects inequities in healthcare access and experience, and reinforces social exclusion beyond the walls of the health facility.

1.2. Allowing for heterogeneity

The thesis highlights heterogeneity – in the effect of healthcare access barriers, policies, and individual attributes – as a key explanation for the persistence of inequalities in maternal health in Zambia. Paper 2 shows that for some healthcare access barriers, the effect of each barrier on access to a facility birth is stronger the fewer other barriers are present. This pattern holds for the psychosocial, geographic and quality barriers. For the other three barriers (affordability, cognitive accessibility and availability), the pattern is unclear but may be in the opposite direction (i.e. the effect of each barrier on access is *stronger* the more other barriers are present), particularly for the cognitive and availability barriers. The first pattern implies, together with evidence that women who are more socio-economically disadvantaged face more barriers, that policies removing a single barrier to healthcare access at a time could aggravate population-level inequities.

Paper 3 demonstrates that health facility rules governing pregnant and birthing women's behaviour have unequal effects in terms of women's experiences of pregnancy and childbirth. While some rules and their corresponding punishment are unequally applied, in a manner that favours those with higher social status or those socially constructed as more vulnerable (young women, unmarried women), the rules mainly enact social exclusion through institutional bias. This is a system whereby the rules are designed for a certain kind of woman, who has access to financial and social resources, and are harder to follow for women with fewer social and financial resources. This not only creates inequalities in women's experiences of pregnancy and childbirth, but also aggravates unequal power relationships and the stigmatisation of socially excluded women, within and beyond the health facility. The rules do not directly stem from national-level policy, but are better characterised as routinised practices by health workers, which are legitimated through "authoritative knowledge" (Jordan, 1997). Pregnant women and women giving birth participate in legitimating the rules and in socially excluding rule breakers, together with health workers.

Paper 4 shows that health service environments explain inequalities in access to facility delivery mostly because of differential propensities to face negative health service environments across socio-economic groups, rather than the different effect of access barriers across groups. An exception is the differential meaning of the cognitive barrier for rural and urban residents, which is more dissuasive for rural residents, and the differential meaning of the psychosocial barrier across wealth and education levels, which is more dissuasive for the more advantaged groups. Marital status, non-employment, and community level norms around who makes decisions about women's healthcare access also have heterogeneous meanings for facility delivery. Being out of work has no effect for women who are not poor but a strongly negative effect for women who are poor. Being married has a negative effect for more educated women but a positive effect for less educated women. For more advantaged women (across all SES dimensions), there is no statistically significant difference in facility delivery according to decision-making practices in the community. For less advantaged women, however, a greater percentage of wives in the community who say their husband decides alone has a large and statistically significant positive effect on facility delivery relative to the percentage of wives who say it is a joint decision. These results show that some women's financial resources are connected to social support, in a way that is strongly and simultaneously gendered and classed.

2. Conceptual and methodological contributions

This thesis innovates by applying a different research approach relative to what is most common in the maternal health literature, by rooting enquiry in multi-disciplinary social science theories, considering a range of analytical levels, and investigating more than one type of outcome. Several conceptual or methodological innovations result from this approach.

The framing of "health service environments" is innovative for the maternal health literature in two respects. It is the first time, to my knowledge, that an attempt is made to both include all the conceptual dimensions of healthcare accessibility in one model, and to measure at least some of these dimensions by exploiting the GIS linking of facility-level data and population-level data. The health service environment is conceptualised as an abstract, meso-level social context or structure, in which births are nested. This framing affects interpretation and policy implications in important ways. For example, the affordability, cognitive and psychosocial accessibility dimensions, while measured at the individual level, are framed as institutional bias or discrimination, which can therefore be redressed at this same institutional level.

The use of MAIHDA in Paper 1 contributes important new insights to the maternal health literature. Classic multivariable regression analysis, which calculates the average and independent effect of each healthcare access barrier on facility delivery, controlling for the others, leaves important questions for policy action unanswered: How much individual-level heterogeneity is there around the mean effect of context? How can we meaningfully compare the effect of distance to the effect of quality care? How can we assess the overall importance of context? MAIHDA enables answers to all these questions by explicitly modelling the amount of heterogeneity across births within the same health service environment relative to births across different health service environments, and uses the share of variance explained as its indicator of importance. This approach matters for policy because where health service environments are shown to have predictive accuracy, they can be targets for policy action. While MAIHDA cannot tell us conclusively whether improving the worst health service environments would improve access to facility delivery for those who currently have the lowest levels of access (although including control variables and cross-classified random intercepts can help make the case for causality), it does justify further investigation and pilot action.

The application of MAIHDA in Paper 1 also contributes to the social epidemiology literature. It is the first time, to my knowledge, that MAIHDA is used in an LMIC context, and the first time it is used to investigate access to healthcare rather than health outcomes. It is also the first time that MAIHDA is used to combine social and geographic dimensions, which specifically responds to a call for innovation by social epidemiologist Juan Merlo and others (2019). In a companion blog to the thesis, my co-author and I develop the insight that this approach has the unique capability to jointly model social structure and individual agency, a longstanding sociological debate (Sochas and Peterson, 2020).

Paper 2 develops and evaluates a new theory: The Concurrent Barrier Hypothesis (CBH), which contributes to the maternal health and social epidemiology literatures and has potential implications for the social policy literature beyond the field of health. CBH posits that removing a single healthcare access barrier could aggravate population-level inequalities if the effect of doing so is greater for those who face fewer other barriers, and if those who face fewer barriers are the most socio-economically advantaged. CBH could be a possible explanation for why policies that remove barriers to healthcare access to do not always improve equity of access. For example, removal of health user fees has been shown to decrease, increase, or have no effect on maternal health inequalities.

CBH also provides a possible mechanism for other social-epidemiology theory, such as the Inverse Equity Hypothesis and Fundamental Causes, which both posit an inverse-U relationship between

average levels of healthcare access and absolute healthcare inequalities. CBH is also innovative in that it incorporates the role of government policy into a theory of health inequalities and explains how and why pro-equity policies could have unintended adverse effects. CBH could potentially be applicable beyond the field of healthcare access, to any social policy area and context where "the worse off face more access barriers than the better off" and "the worst-off are not the only group to face any barrier". The process whereby public services, such as active labour market policies or childcare services, are monopolised by the more advantaged has been called a "Matthew effect" in the European social policy literature (Bonoli and Liechti, 2018; Pavolini and Van Lancker, 2018). However, the role of interactions between barriers as a mechanism behind Matthew effects has, to the best of my knowledge, not yet been explored.

Paper 3 contributes to a theoretical framework of social exclusion and to the framing of disrespectful maternity care. It suggests a possible extension to Kabeer's (2000) analytical framework of social exclusion, by demonstrating that health facility rules are not only shaped by social processes, but actively influence and participate in these social processes as well. For instance, the pressure to follow the rules or seek exemptions may force women lacking resources to occupy a further diminished position in society. Similarly, women who do not follow the rules are constructed as bad women, which reinforces socially excluded women's perceived immorality outside of the health facility.

Secondly, Paper 3 argues for a redefinition of what should count as disrespectful maternity care, in order to include institutionally biased facility rules in its definition. Currently, disrespectful maternity care is defined as "specific provider behaviours experienced or intended as disrespectful and humiliating" as well as "systemic deficiencies that create a disrespectful or abusive environment" (Freedman et al., 2014). Paper 3 shows that breaking health facility rules that govern women's behaviour in pregnancy and childbirth can result in fines, exclusion from care, or health worker behaviours such as shaming, shouting, scolding, or beating. It also shows that these practices, when experienced as punishment for breaking the rules, are widely (though not universally) seen as legitimate by the women who experience them and the health workers that implement them. Finally, these rules result in stigma and shame for disadvantaged women regardless of whether the health worker is disrespectful or not – much of this stigma is internalised or constructed by other "patients" and people beyond the health facility, not only by health workers.

Together, these insights challenge the accepted discourse on disrespectful maternity care in the maternal health literature. They show that (1) the same provider behaviours that are typically labelled as "disrespectful care" are widely seen as legitimate in this context, when interpreted as a punishment for not following the "rules", and therefore do not qualify as disrespectful behaviour under the current definition. (2) These rules are not necessarily driven by systemic deficiencies (which fits the current definition), but more likely by a system of reversed accountability driven by quantitative targets and a social context that values "modern", "respectable" women. (3) Finally, the stigma that socially excluded women encounter because of the rules, and the possible disrespectful behaviour stemming from it, is not only created by providers, but strongly reinforced by attitudes of other pregnant or birthing women. This insight advocates for the concept of disrespectful care to be widened beyond the provider-patient relationship, and to consider how providers' authoritative knowledge contributes to inequitable relationships within society more broadly.

Lastly, Paper 4 proposes a novel empirical approach for researchers of health inequalities to avoid "categorical thinking", the practice of treating social categories as de-contextualised, natural, and internally homogeneous. This approach involves theoretical grounding across multiple levels of social processes; mixed use of data and methods; examining the context-specific meanings of socioeconomic

categories; analysing inequality based on multiple measures of social status; considering the heterogeneous effect of explanatory variables across SES levels; and finally contextualising the study's results within macro-level, mutually constitutive and unequal power relations.

This approach directly responds to the research agenda set by quantitative intersectional scholars by grounding analysis in theory, using multiple levels of analysis, and understanding the context-specificity of categories. The approach is innovative in how it uses qualitative data to reveal the context-specific meaning and social construction of the multiple socio-economic categories used in the quantitative analysis. It resists easy classification, at the crossroads of Evans' (2019a) spectrum of intersectional analysis, and employs strategies from each of the three approaches to intersectional complexity described by McCall (2005). This paper specifically contributes to the field of global health, which is particularly prone to categorical thinking (Adams et al., 2019), especially since quantitative intersectional studies of health inequalities are typically not conducted in LMICs.

3. Implications for maternal health policy in Zambia

3.1. Where is Zambia now? Results from the 2018 DHS

The 2018 DHS, published in January 2020, demonstrates further improvements in both average access to facility delivery (67% to 84%), and in reducing inequalities, compared to the 2013-14 DHS (Figure 1). The absolute difference in access between the richest (Q5) and poorest wealth quintiles (Q1) decreased from 46 percentage points for the 2008-13 period to 23 percentage points for the 2013-18 period, while the ratio of the richest quintile's average healthcare access to the poorest reduced from 1.9 times to 1.3 times (Table 1). The poorest wealth quintile now has average levels of access of 72.5%, relative to near universal access among the richest (95.9%). The government has succeeded in substantially reducing inequalities in access to facility delivery since 2007, and most gains in average coverage have come from poorer wealth quintiles. Evans (2018a) attributes Zambia's success in improving average levels of coverage to a top-down target culture, with high-level political prioritisation for improving coverage in facility delivery.

Figure 1: Evolution of wealth inequalities in facility delivery, 1996-2018, Zambia DHS

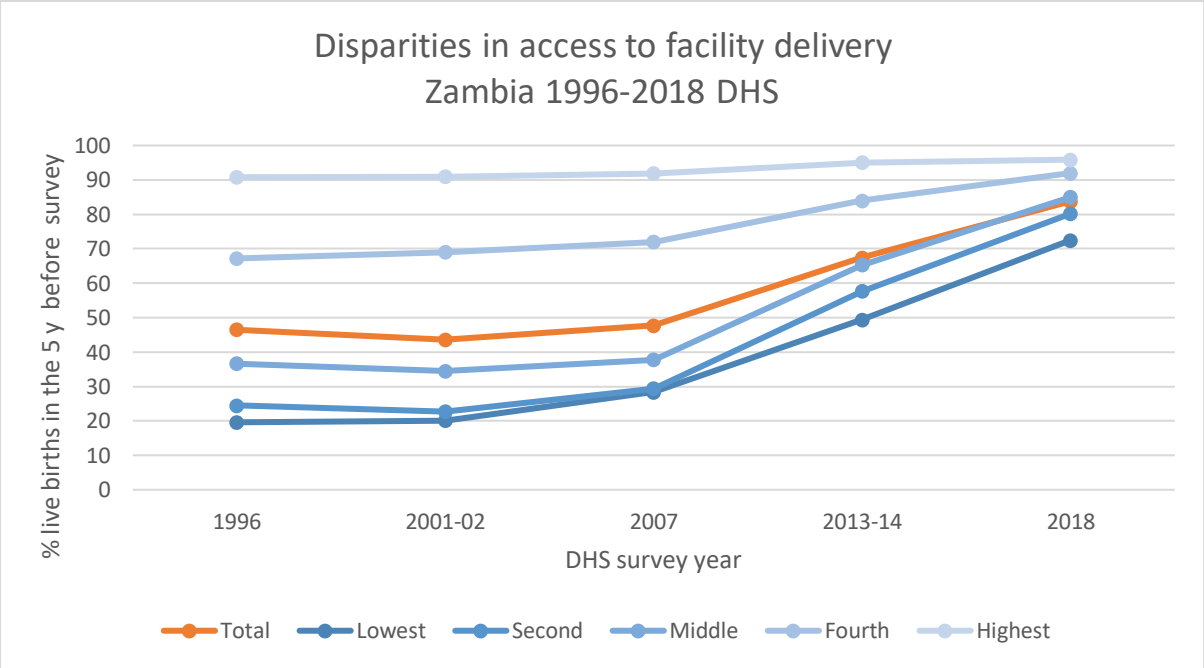


Table 1: Evolution of absolute and relative wealth inequalities in facility delivery, 1996-2018, Zambia DHS

DHS year	Absolute inequality Q5-Q1 (p.p.)	Relative inequality Q5/Q1
1996	71.2	4.6
2001-02	70.9	4.5
2007	63.5	3.2
2013-14	45.7	1.9
2018	23.4	1.3

Note: p.p. : Percentage points. Q5: Richest wealth quintile. Q1: Poorest wealth quintile.

3.2. Facility rules and social exclusion

Given the progress made in reducing inequalities in access to facility birth (Table 1), this thesis' main implication for Zambian policy relates to the inequitable effect of facility rules for women's experience of pregnancy and childbirth. While Paper 3 does not investigate the origin of the facility rules (and sanctions), many other studies link the introduction of fines for home births to "reversed accountability" structures, where international and domestic pressures lead provincial and district officers and health workers to make mothers responsible for meeting targets (Chimhutu et al., 2014; de Kok, 2019; Greeson et al., 2016; Kvernflaten, 2013; Lodenstein et al., 2018; Melberg et al., 2016). This reminds us that while numeric targets and international tracking are successful in driving progress on prioritised indicators, there may be unintended consequences in relation to other aspects of maternal health and wellbeing that remain unmeasured. This is particularly likely to be the case when underlying power relations, according to which Zambian women with fewer social and financial resources are the least powerful, go unchallenged.

Findings from Paper 3 imply that sufficient resources should be allocated to districts and health facilities for them to provide all required materials to women in childbirth (including support for baby clothes and materials where needed) (Figure 2 below). In parallel, equity awareness training should be incorporated into health workers' pre-service education, for health workers to better understand and redress stigmatizing behaviours. There should be further discussion and consultation at the district-level on how facility rules advantage some women over others, which should include all women's perspectives. The system of "reversed accountability", whereby women are fined, punished or shamed for delivering at home or coming to antenatal care without their husband, should be challenged. One way to achieve this could be to include patient reported outcomes in national and district-level accountability processes, disaggregated by socio-economic and marital status. There should also be greater understanding and monitoring at the national level of what actions and policies are employed on the ground to achieve quantitative objectives at province, district and facility levels, and a regular dialogue should be established about what are acceptable vs. unacceptable strategies.

3.3. Health service environments

Investing in health service environments may be successful in maintaining high levels of facility delivery and continuing to decrease inequalities, without resorting to fines and strong peer and institutional pressure (from health workers, traditional authorities and district health officials). The thesis does not provide evidence to show that investing in health service environments would be an effective substitute to these pressures, and it should be noted that the Government of Zambia has already made some improvements to the health service environment, for example by abolishing user

fees and committing to building 650 additional health posts. However, the thesis shows that in 2008-2013, health service environments were strongly predictive of facility delivery, and that the kind of environment faced by a given individual was strongly determined by their socio-economic status. This remains true after controlling for important potential confounders (in Paper 1 and 4), and clustering at the community level (in Paper 1). While this evidence is not sufficient to justify a strong causal claim, it can arguably make at least a weak case for causality. At the very least, this thesis' evidence justifies pilot action, particularly if similar patterns can be shown for the 2013-2018 period.

How should health service environments be improved? Improving geographic accessibility, availability and quality of care means building more facilities, staffing them with qualified, well-paid and well-supervised health workers, with the skills, materials and infrastructure necessary to provide quality of care for births with and without complications. It could also mean providing additional well-maintained ambulances and drivers, improving the conditions of roads, and reimbursing patients' taxi fares. Removing the affordability, cognitive and psychosocial access barriers means creating a health service environment where wealth or birth order are not a factor of social exclusion. In practice, this could mean ensuring that all necessary materials for giving birth are provided to birthing women by the healthcare system; creating programmes to subsidise the cost of transport to the facility; effectively communicating to women through community-based channels that while complications are indeed less likely for multi-parous mothers (up to high parities), life-threatening complications can occur at any parity; and providing education, supportive supervision, and management for health workers in order to protect all women's right to respectful healthcare, regardless of their social position or circumstances.

Paper 1 implies that under a progressive universalism approach, where we aim for universal coverage by making most progress among those that are least privileged (Gwatkin and Ergo, 2011), we should target the worst health service environments. How exactly would that work in practice, since these environments are abstract and multidimensional? Regarding the three "geographic location" dimensions, prioritising the worst health service environments means building, staffing, and upgrading facilities in places where these facilities are least available. This has potential cost-effectiveness and quality implications, to the extent that prioritising underserved areas may also mean prioritising less populated areas, where there may not be enough (complicated) births for midwives to maintain their skills. Where these concerns apply, improving the availability, speed and cost of home-to-facility transport may be one solution, as well as improving primary care-to-secondary care transport for complicated deliveries. Another solution may be to make use of cadres that have midwifery skills as well as general nursing skills, providing regular refresher skill sessions for health workers serving underpopulated areas (though travelling for work may not always be feasible), or developing tele-supervision. Equity may also be valued above cost-effectiveness and some (acceptable) loss in quality of care. This should be a political decision based on values, not a technical one.

The "social location" dimensions appear to demand interventions that are national and structural in nature, particularly as they relate to institutional discrimination, which may partly originate in health workers' training programmes. However, it is highly likely that in addition to national-level efforts to change workplace culture or "facility rules", additional focus and follow-up will be required at district and facility levels. I have argued that the "facility rules", while likely influenced by the global and national context, appear to be developed and implemented at district level. Prioritising the worst health service environments, therefore, may mean driving efforts to reform institutional discrimination in the most geographically underserved environments, or conversely removing barriers

to geographic access as a priority for those who are institutionally discriminated against (e.g. by using transport vouchers – though targeting government benefits in this way can also be stigmatising).

Paper 1 further argues that since the "geographic location" dimensions are more predictive of facility delivery, we might want to specifically target these dimensions to improve equity of facility delivery. This recommendation is conditional on the outcome of facility delivery – it may be that the "social location" dimensions would be more important if we were concerned with equity in maternal wellbeing, for example. Secondly, Paper 2 alerts us to the possibility of interactions between healthcare access barriers, implying that where interactions are present, removing a single barrier to healthcare access may aggravate inequities instead of improving them. It is therefore safer, in the absence of evidence about interactions, to address healthcare access barriers together, as a multidimensional context or environment, rather than as individual policy levers.

3.4. Mutually constitutive social processes

Paper 4 explores mutually constitutive, macro levels of explanation: gender relations, colonial and global influences, power relations between classes. While these levels of explanation are difficult to target and change (though not impossible, with political action over time), they are important to consider in order to foresee and avoid unintended consequences of policies. In the case of Zambia, for example, it appears that the least powerful stakeholders, pregnant and birthing women, are expected to bear responsibility (enforced using fines, exclusion from care, and stigma) for an international target on facility delivery.

Paper 4 also demonstrates that factors such as autonomy, work and marriage, among others, do not have straightforward meanings for facility delivery, but rather have situated meanings depending on the level and dimension of socio-economic status. This finding should be taken into account by programmes that seek to promote women's empowerment or male involvement in pregnancy and childbirth (the latter should also avoid creating rules mandating male involvement, as shown in Paper 3). These programmes should acknowledge and respond to the fact that who is involved or makes decisions about pregnancy and childbirth has different implications for different types of women, and that these are social behaviours that are profoundly embedded in mutually constitutive and unequal power relations. Interventions that do not address these power relations, for example by denying women access to antenatal care if they come without their husband, could result in further harm.

Finally, Paper 4 suggests that facility delivery is constructed as a "modern" and moral choice for respectable women, and that social interactions in facilities around pregnancy and childbirth reinforce stigma against (some) rural, poor or uneducated women, who are not seen as modern or morally deserving. This implies that equity of esteem around institutional childbirth, beyond mere equity of access, will require the very meaning of facility delivery to change.

3.5. Implications for maternal health policy in other settings

While the results of this thesis are specific to the Zambian context, this thesis also has broader implications for maternal health policy in other settings. Firstly, national policy-makers and global health advocates or policy advisors should consider the health service environment, both in its geographic distribution, and in the way in perpetrates institutional discrimination, as a possible target for policy intervention to reduce maternal health inequities. Evidence from the context in question will be required, as well as the political motivation to take action (and allocate funds) at the health system level instead of framing "non-compliant" women as the problem.

Secondly, the thesis brings to the fore the possibility for interactions between access barriers to a public service, in the health sector or beyond. In settings where more disadvantaged groups face

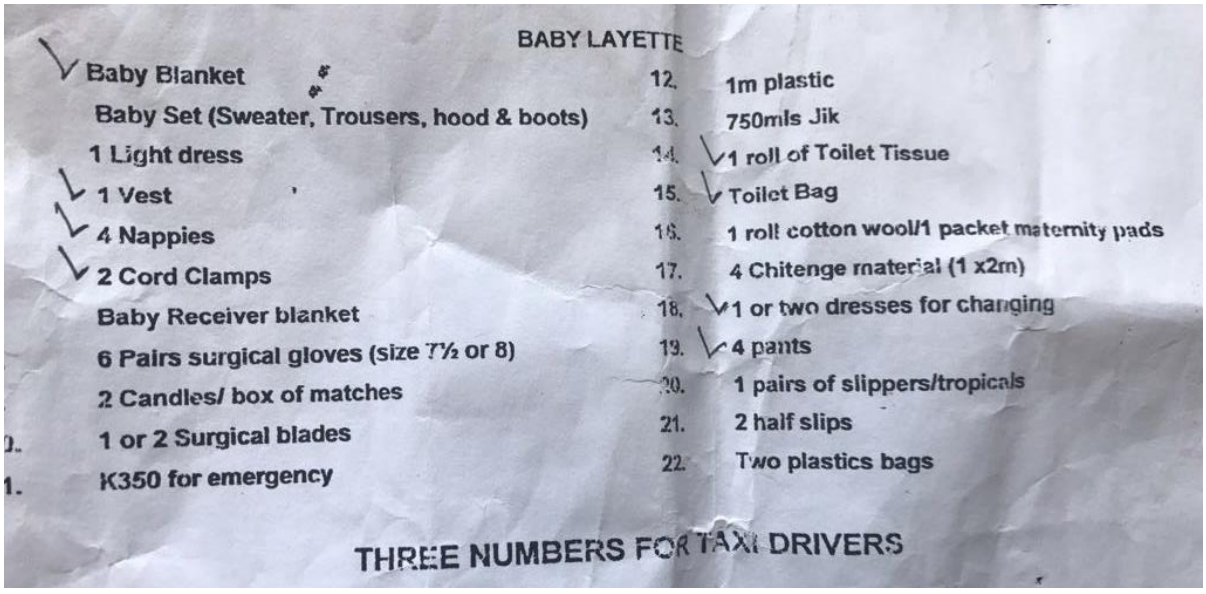
more barriers, but where the more privileged groups still face some, a policy that removes a single barrier for the entire population might inadvertently aggravate inequities if the effect of a given barrier on access is stronger the fewer other barriers are present. Where evaluation shows that such a situation applies, governments should choose to either remove all interacting barriers at once, or remove the barrier for the most vulnerable population groups only.

Thirdly, the thesis argues for a change in the way that disrespectful maternity care is characterised, and therefore addressed, in policy. Paper 3 makes a strong case for including moralised facility rules about women's behaviour in pregnancy and childbirth as an instance of disrespectful care, which should be challenged by policy at all levels. The potential for such public health rules to create inequities is strong regardless of the health area or the setting, as has previously been shown with public health rules around diet in the USA, breastfeeding in the UK or France, or sanitation in a range of LMICs. Most recently, it is arguable that the use of moral arguments to urge the public to abide by social distancing measures during the COVID-19 pandemic once more creates inequities. These arguments conceal the fact that people of different socio-economic status, gender, and race face widely different constraints and opportunities in abiding by the rules.

4. Further research

Section 2 described how this thesis has developed new approaches to research. Here I describe how this thesis' research could be extended and improved. Research on health service environments would benefit from nation-wide data with better indicators at the intersection between population needs and health service supply. One of the seven dimensions of the framework of healthcare accessibility used in this thesis could not be measured, administrative accessibility. In order to measure this, health facility-level datasets could collect information on de facto (rather than de jure) opening hours, rules mandating that husbands accompany their wives to register the pregnancy during the first antenatal care visit, whether healthcards are confiscated at the start of antenatal care sessions, etc. In this thesis, the affordability, cognitive accessibility and psychosocial accessibility dimensions could not be measured at the intersection of health service characteristics and health user characteristics. I would recommend collecting data on informal fees or in-kind resources required by different health facilities (e.g.: a list of such items is shown in Figure 2); efforts to disseminate biomedical information about pregnancy risks and to take pregnant and birthing women's knowledge seriously; and staff attitudes towards socially excluded women (rural, poorer, less educated, high parity, unmarried, too young, too old, and the intersections thereof).

Figure 6: List of childbirth items required by a health facility in Lusaka, Zambia, June 2018



It will be important to replicate the evaluation of CBH in different contexts, to understand how broadly the theory applies. I would recommend doing so with a larger sample than I was able to use in my own analysis, which may have been responsible for insignificant interaction terms. It will also be important to causally test CBH with respect to one barrier at a time, making use of policy evaluations and incorporating tests of heterogeneous effects according to the number of other barriers faced. Finally, CBH could apply to a wider range of settings beyond health – replicating its evaluation in terms of access to education, housing, voting, or jobs could contribute to the social policy literature.

While Paper 3 documents the health facility rules and demonstrates their unequitable effects, the study did not collect comprehensive data on the origin of the rules or the perception and application of the rules from the perspective of health workers or district health officials (beyond limited ethnographic observation and notes). In order to potentially change these rules, evidence on their origin and application will be important. Such evidence would also be able to contribute to the literature linking such rules to a quantitative target culture. While the paper suggested that the rules may affect women's wellbeing in pregnancy and childbirth, the study's focus was on the much more nebulous concept of "*experience"* of pregnancy and childbirth. Future data collection and analysis could measure and analyse the potentially unequitable effect of rules on women's well-being in a more direct and evidenced way.

Paper 4 framed and interpreted the quantitative and qualitative analyses within macro, mutually constitutive social processes, by primarily using other authors' studies. Primary sociological and historical research on this topic would serve to make these links more directly and persuasively. In reviewing the literature, I was unable to find research documenting how colonial powers in Zambia influenced childbirth and reproductive practices, and whether they had a pro- or anti-natalist stance (although the former is more likely). Most of this literature in Sub-Saharan Africa focuses on the Democratic Republic of Congo, East African countries and Zimbabwe.

A key message of this thesis, in its introductory framing and in each of its papers, is that the way in which we conduct research matters for policy and politics (and is usually highly influenced by policy and politics in the first place). One aspect of this relates to who conducts research. Rectifying power imbalances that make it harder for Global South researchers to receive research funding and to publish is important since the researcher's positionality affects both the questions asked and the answers received (Valles, 2018; Walsh et al., 2016). Another conclusion of this thesis is the importance of

grounding research in theory, considering different levels of analysis, and researching different outcomes. By theory, I do not necessarily mean grand social science theories, though these can contribute novel insights, but at the very least a conceptual framework to guide, and most importantly clarify, the underlying assumptions of analysis. I argue for the inclusion of different levels of explanation in analyses, by considering the potential importance of social structure, health service infrastructure and practices, and macro-level context. This may require different or additional data collection efforts. While doing so may be expensive, it is a necessary price to pay in order to contribute a critical perspective on *what* needs to change and *who* needs to change it. Finally, researching different outcomes in addition to health facility delivery and maternal mortality is key to retaining a critical eye with regards to well-worn policies in the field of maternal health. Some of these outcomes will best be investigated using qualitative research. While such research is currently less valued in policy-making and funding circles, researchers have an ethical imperative to continue to educate those with political power about the value of such work, in itself a political project.

Thesis Appendices

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Thesis Appendix 1. Quantitative data

DHS sample selection

In the DHS dataset, births to mothers who migrated since the birth were excluded, as their residence at the time of the birth could not be obtained (21,034 excluded out of an original sample of 49,207). Non-singleton births were excluded since they constitute a medical complication that is often identified prior to the birth, such that the determinants of access to care in childbirth are fundamentally different to non-singleton births (496 excluded out of 28,173). Births that occurred prior to 2008 were excluded, as the location of the birth was not recorded in the survey (16,392 excluded out of 27,677). Births that did not have a valid geo-reference were excluded (two sampling clusters and 45 births out of 11,285). Births that were not located in one of the 17 SARA districts were excluded (466 sampling clusters and 7,671 births out of 11,240). The identification of DHS sampling clusters' districts was conducted in ArcGIS, using the JOIN BY LOCATION tool and Zambian district shapefiles (Hijmans, 2015). This left 3,569 births in 253 clusters. The final analytical sample in different papers differs because of complete case analysis, which dismissed observations missing data on covariates or outcomes.

SARA sample selection

In the SARA dataset, originally composed of 658 facilities, 17 facilities were dropped due to having no or incorrect geo-references and 45 were excluded due to being identified as located outside of the SARA districts' shapefiles (Hijmans, 2015). The final sample is made up of 596 facilities.

Linking SARA and DHS – Geographic accessibility

I calculate distance from every DHS cluster (253 clusters) to its nearest health facility, in meters, using the NEAR tool and "geodesic" method in ArcGIS. Geodesic distance takes into account the Earth's curvature and is therefore more accurate than Euclidian distance, which calculates distance on a two-dimensional plane (Flater, 2011).

Defining geographic accessibility: A birth is defined as having geographic accessibility at the 10km level if the mother's DHS cluster is within 10km of its nearest health facility (same for the 5km level). Note that geographic access does not presume that the health facility provides childbirth services. This choice -albeit imperfect - was made for three reasons. Firstly, in order to better distinguish between the dimension of geographic access and the dimension of availability (since the vast majority of facilities with childbirth services also have midwives, i.e. the indicator chosen to measure availability). Secondly, the first screening question about whether the facility provides childbirth services is phrased as: "Does this facility provide obstetric services", which can be interpreted as medical-level interventions (i.e. signal functions), instead of "normal" delivery services provided by a midwife (Figure 1).

Figure 1: Extract from the 2010 SARA core questionnaire for primary-level facilities, version 2.0, May 2010, p.20

Safe Delivery/ Obstetric Care and Postpartum Services			
525	Does this facility offer obstetric care services?	Yes .....1 No 2	➔ 527
526	Which of the following obstetric care services does this facility provide?		
A	Delivery services at the facility	Yes .....1 No 2	
B	Parenteral administration of antibiotics	Yes .....1 No 2	
C	Parenteral administration of oxytoxic drugs	Yes .....1 No 2	
D	Parenteral administration of anti-convulsants to women with (pre)clampsia	Yes .....1 No 2	
E	Manual removal of placenta	Yes .....1 No 2	
F	Removal of retained products after delivery	Yes .....1 No 2	

G	Home visits by skilled worker to provide delivery care services at home	Yes .....1 No 2	
527	Does this facility offer postpartum services?	Yes .....1 No 2	➔ 529

Linking SARA and DHS – Availability and Quality

In the SARA dataset, I started by defining whether each facility had any midwife (availability), and whether they had the capacity to provide CEMONC (perceived quality of care).

Defining availability: Facilities were coded as having at least one midwife if they reported at least one full-time midwife.

Defining perceived quality of care: Facilities were coded as having the capacity to provide CEMONC if they said they provided obstetric care services (question 525) and if they said they provided caesarean section services (asked only of hospitals, question 517l). Note that this definition is intentionally wide, and allows for incomplete CEMONC services, since it did not include transfusion or the BEMONC signal functions.

In ArcGIS, I defined 10km buffers around the 253 DHS clusters, using the BUFFER tool (geodesic method). I selected the facilities that fell within each of those buffers, using the SELECT BY LOCATION tool, and saved those facilities. I then joined the DHS clusters to the facilities within 10km of them, using JOIN BY LOCATION tool. Each polygon (i.e. the DHS 10km buffers) is given a summary of the numeric attributes of the points (i.e. health facilities) that fall inside it. I chose Maximum as the summary measure, which summarises the maximum level of midwife availability and CEMONC capacity with the 10km buffer around the DHS sampling cluster. This whole process was repeated, separately, for the sensitivity analysis with 5km.

GIS covariates

In the first paper, a GIS covariate is used as a control: cluster slope. This covariate is drawn from the DHS programme's GIS covariates dataset for Zambia (DHS Program, 2017). The measure is from 1996, and refers to how "*rough the terrain around a DHS cluster is*", using the average slope across all raster cells falling within a 10km distance of rural clusters and a 2km distance around urban clusters. "*The United States Geological Survey GTOPO30 digital elevation model was processed into slope by using the slope tool in ArcMap 10.5.0.*" (DHS Program, 2017, p. 37).

Missing data

Missingness on the outcome variable, facility delivery, is high enough to be problematic, whereas missingness on the key covariates is low enough to make bias unlikely (Table 1).

In Paper 1, missing data on the outcome variable is automatically imputed through the Bayesian model, using the covariates used in the substantive analysis. Uncertainty related to the imputation is fully taken into account. Bayesian modelling is also better able to take into account the multilevel structure of the data when conducting the imputation, compared to the multiple imputation method (Best and Mason, 2012).

In Paper 2 and 4, the sample is composed of units with no missing observations on any variables used in the model (complete case analysis), and the missing data on the outcome variable is not automatically imputed since the analysis is frequentist, not Bayesian. I make the assumption that the missing values on the outcome variable, facility delivery, are "Missing At Random" given the covariates. This assumption implies that the missingness pattern can be completely explained by the covariates. According to Gelman and Hill (Gelman and Hill, 2006, p. 530): "*When an outcome variable is missing at random, it is acceptable to exclude the missing cases (that is, to treat them as NA's), as long as the regression controls for all the variables that affect the probability of missingness*." While it is not possible to test this assumption, the in-depth interview data indicated that not delivering in a health facility is quite stigmatised (and illegal in some places). This implies that the missing values are more likely to be births that did not take place in facilities, such that the predictors for whether a birth occurred in a facility are also likely to be relevant in predicting this variable's missingness. On the other hand, not all predictors of health facility delivery are included in the model, and to the extent that this is true, we have a "Not Missing At Random" situation, where the bias due to missingness cannot be corrected because missingness depends on the missing variable itself.

Table 1: Missingness in analytical sample.

	Sample of births (N % missing)
Facility delivery	3,081 (488; 13.7%)
Affordability barrier *Two poorest wealth quintiles*	3,569 (0; 0%)
Cognitive barrier *Birth order 1 +*	3,569 (0; 0%)
Psycho-social barrier *Birth order 6 +*	3,569 (0; 0%)
Geographic barrier *No health facility within 5km*	3,569 (0; 0%)
No health facility within 10km	3,569 (0; 0%)
Availability barrier *No midwife*	
No midwife within 5km	3,481 (88; 2.5%)
No midwife within 10km	3,473 (96; 2.7%)
Quality of care barrier *Not CEMONC*	
No CEMONC within 5km	3,481 (88; 2.5%)
No CEMONC within 10km	3,473 (96; 2.7%)

Thesis Appendix 2. Key informant interviews: data collection forms

Key informant interview guide

Purpose (for methodology; will not be shared with the respondent)

The purpose of the key informant interviews is, in order of importance:

To choose one variable from the shortlist within each concept category – the one deemed to best measure the concept will be selected.
To understand the extent to which the best available variable is a good measure of the concept, and why.
To check that there are no other possible variables that I wasn't aware of.

SEND RESPONDENTS THE FRAMEWORK AND VARIABLES LIST IN ADVANCE

Interview guide

SECTION 1	
READ OUT	*This is the framework I will be using to analyse accessibility to maternal health services in Zambia [give the respondent a copy of the framework].* *This framework says that if a person enjoys all seven types of accessibility, then there are no internal or external barriers standing in the way of her healthcare utilisation. Please take a moment to read through the definition of the seven dimensions.*
Q1.1	Can you think of any accessibility dimensions that are missing? If yes, why?
Q1.2	Do you have any questions about the framework?

SECTION 2	
READ OUT	*This is a list of potential variables I could use to measure each of these seven accessibility dimensions [give the respondent a copy of the variable list]. I would like to go through the variables and assess the extent to which they are good measures of the concepts.*
READ OUT	*We are first going to consider variables related to **Availability**. Just to remind you, the definition of Availability I am using is "The relationship between the volume and type of existing services and the clients' volume and types of needs" (P & T 1981).* *In other words, a lack of availability occurs when there is too much demand or need for health services relative to the amount of health services available.*
Q2.1	Considering the possible variables below, which one best measures the concept of Availability in the context of maternal and newborn health in Zambia? Please also consider the accuracy of data sources in your answer.

	Number of skilled birth attendants per 10,000 women of reproductive age, by health facility level
	Number of beds per 10,000 women of reproductive age, by health facility level

		Patient-rated availability of qualified staff at the health facility (imputed values based on sample)
		Patient-rated waiting time at the health facility (imputed values based on sample)
Q2.2	Why did you choose [this variable] above [those variable]?	
Q2.3	Now thinking of each variable separately, to what extent is the "Number of skilled birth attendants per 10,000 women reproductive age, by health facility level" a good measure of Availability in this context? Sliding scale between "Very poor measure" and "Very good measure"	
Q2.4	To what extent is the "Number of beds per 10,000 women of reproductive age, by health facility level" a good measure of Availability in this context? Sliding scale between "Very poor measure" and "Very good measure"	
Q2.5	To what extent is the "Patient-rated availability of qualified staff at the health facility (imputed values based on sample)" a good measure of Availability in this context? Sliding scale between "Very poor measure" and "Very good measure"	
Q2.6	To what extent is the "Patient-rated waiting time at the health facility (imputed values based on sample)" a good measure of Availability in this context? Sliding scale between "Very poor measure" and "Very good measure"	
Q2.7	*[If the sliding bar gives a different answer to the ranking]* You scored [this variable] better than [that variable] despite picking [that variable] as the best measure in the question above. Why is this?	
Q2.8	Can you think of a better variable to measure Availability, and for which data would be available in Zambia, that is not in the list?	
READ OUT	*We are now going to consider variables related to **Geographic accessibility**. Just to remind you, the definition of Geographical accessibility I am using is "The relationship between the location of health services and the location of clients, taking into account client transportation resources and travel time, distance and cost" (P & T 1981)"* *In other words, a lack of Geographic accessibility occurs when health services are too far away given available transport options.*	
Q2.9	Considering the possible variables below, which one best measures the concept of Geographical Accessibility in the context of maternal and newborn health in Zambia? Please also consider the accuracy of data sources in your answer.	
		Straight-line distance between the DHS sampling cluster and the nearest health facility that offers maternity services
		Household ownership of transport assets (see list)
		DHS cluster ownership of transport assets (see list)
		Whether the health facility has an ambulance (imputed values based on sample)
		DHS cluster average for "Did not deliver at a health facility because too far/no transport"
Q2.10	Why did you choose [this variable] above [those variables]?	
Q2.11	Now thinking of each variable separately, to what extent is "Straight-line distance between the DHS cluster and the nearest health facility that offers maternity services" a good measure of Geographic Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"	

Q2.12	To what extent is the "Household ownership of transport assets" a good measure of Geographic Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.13	To what extent is the "DHS cluster ownership of transport assets" a good measure of Geographic Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.14	To what extent is "Whether the nearest facility has an ambulance (imputed values based on sample)" a good measure of Geographic Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.15	To what extent is the "DHS cluster average for 'Did not deliver at a health facility because too far/no transport" a good measure of Geographic Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.16	*[If the sliding bar gives a different answer to the ranking]* You scored [this variable] better than [that variable] despite picking [that variable] as the best measure in the question above. Why is this?
Q2.17	Can you think of a better variable to measure Geographic Accessibility, and for which data would be available in Zambia, that is not in the list?
READ OUT	*We are now going to consider variables related to **Affordability**. Just to remind you, the definition of Affordability I am using is "The relationship of prices of services to the clients' income, ability to pay, and health insurance" (P & T 1981)"* *In other words, there is a lack of affordability where clients cannot afford the cost of accessing healthcare*
Q2.18	Considering the possible variables below, which one best measures the concept of Affordability in the context of maternal and newborn health in Zambia? Please also consider the accuracy of data sources in your answer. ☐ Average cost of maternity services at the health facility, excluding transport costs (imputed values based on sample) ☐ Health facility is private or public ☐ Whether the respondent has health insurance
Q2.19	Why did you choose [this variable] above [those variables]?
Q2.20	Now thinking of each variable separately, to what extent is "Total cost of accessing health services (imputed values based on sample)" a good measure of Affordability in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.21	To what extent is the "Nearest health facility is private or public" a good measure of Affordability in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.22	To what extent is "Whether the respondent has health insurance" a good measure of Affordability in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.23	*[If the sliding bar gives a different answer to the ranking]*

	You scored [this variable] better than [that variable] despite picking [that variable] as the best measure in the question above. Why is this?
Q2.24	Can you think of a better variable to measure Affordability, and for which data would be available in Zambia, that is not in the list?
READ OUT	*We are now going to consider variables related to **Administrative accessibility**. Just to remind you, the definition of Administrative accessibility I am using is "The relationship between the manner in which the supply resources are organised to accept clients and the clients' ability to accommodate to these factors, and the clients' perception of their appropriateness" (P&T 1981)* *In other words, there is a lack of administrative accessibility where the rules around how health services are delivered (to whom, when, on which administrative condition) make it difficult for people to use services when they need them.*
Q2.21	To what extent is "Opening hours (imputed values based on sample)" a good measure of Administrative accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.22	Can you think of a better variable to measure Administrative accessibility, and for which data would be available in Zambia, that is not in the list?
READ OUT	*We are now going to consider variables related to **Perceived quality of care**. Just to remind you, the definition of Perceived quality of care I am using is "Clients' perception of the extent to which they are likely to receive effective biomedical care at their most accessible facility."*
Q2.25	Considering the possible variables below, which one best measures the concept of Perceived quality of care in the context of maternal and newborn health in Zambia? Please also consider the accuracy of data sources in your answer. ☐ EMONC signal functions at the health facility (imputed values based on sample) ☐ Index of availability of water, electricity and radio/telephone communications at the health facility ☐ Patient-rated availability of drugs at the health facility (imputed values based on sample) ☐ Patient-rated availability of diagnostic capacity at the health facility (imputed values based on sample)
Q2.26	Why did you choose [this variable] above [those variables]?
Q2.27	Now thinking of each variable separately, to what extent is the "EMONC status (imputed values based on sample)" a good measure of Perceived quality of care in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.28	To what extent is the "Index of availability of water, electricity and infrastructure" a good measure of Perceived quality of care in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.29	To what extent is "Patient-rated availability of drugs (imputed values based on sample)" a good measure of Perceived quality of care in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.30	To what extent is "Patient-rated availability of diagnostic capacity (imputed values based on sample)" a good measure of Perceived quality of care in this context? Sliding scale between "Very poor measure" and "Very good measure"

Q2.31	*[If the sliding bar gives a different answer to the ranking]* You scored [this variable] better than [that variable] despite picking [that variable] as the best measure in the question above. Why is this?
Q2.32	Can you think of a better variable to measure Perceived quality of care, and for which data would be available in Zambia, that is not in the list?
READ OUT	*We are now going to consider variables related to **Cognitive Accessibility**. Just to remind you, the definition of Cognitive accessibility I am using is "Awareness of how to access health services, of pregnancy risks, and of the benefits of ideal biomedical care, for herself or her children"* *In other words, cognitive accessibility describes knowledge of when one requires healthcare, how healthcare will make one better, and how one might go about accessing healthcare when needed.*
Q2.33	Considering the possible variables below, which one best measures the concept of Cognitive Accessibility in the context of maternal and newborn health in Zambia? Please also consider the accuracy of data sources in your answer. ☐ Told to look out for things that might suggest problems with the pregnancy during any ANC visit ☐ Birth preparedness plan was discussed with an ANC provider ☐ Listened to Your Health Matters or other health-related radio or TV programmes in the last six months ☐ Index of biomedical knowledge about health issues (fertility, family planning, TB, HIV. Fistula, ORS, STIs)
Q2.34	Why did you choose [this variable] above [those variables]?
Q2.35	Now thinking of each variable separately, to what extent is "Told to look out for things that might suggest problems with the pregnancy during any ANC visit" a good measure of Cognitive Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.36	To what extent is the "Birth preparedness plan was discussed with an ANC provider" a good measure of Cognitive Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.37	To what extent is "Listened to Your Health Matters or other health-related radio or TV programmes in the last six months" a good measure of Cognitive Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.38	To what extent is "Index of knowledge about other health issues" a good measure of Cognitive Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.39	*[If the sliding bar gives a different answer to the ranking]* You scored [this variable] better than [those variables] despite picking [that variable] as the best measure in the question above. Why is this?
Q2.40	Can you think of a better variable to measure Cognitive Accessibility, and for which data would be available in Zambia, that is not in the list?
READ OUT	*We are now going to consider variables related to **Psycho-social Accessibility**. Just to remind you, the definition of Psycho-social Accessibility I am using is the "Extent to which*

	clients are constrained by psychological, attitudinal or social factors in seeking out services" (B et al 1995). *Examples of where psycho-social accessibility is absent include situations where access would entail feeling shame; fear of disrespect from health workers and others; or where access is limited by a lack of agency; lack of self-entitlement; unacceptable care in the context of one's beliefs.*
Q2.41	Considering the possible variables below, which one best measures the concept of Psycho-social Accessibility in the context of maternal and newborn health in Zambia? Please also consider the accuracy of data sources in your answer. ☐ No female skilled birth attendant at the closest health facility ☐ Index of questions measuring the extent to which the woman is involved in day to day decisions around the household, including her own health-seeking ☐ Patient-rated availability of privacy at the health facility (imputed values based on sample) ☐ Patient-rated staff attitude at the health facility (imputed values based on sample)
Q2.42	Why did you choose [this variable] above [those variables]?
Q2.43	Now thinking of each variable separately, to what extent is "No female skilled birth attendant at the closest health facility" a good measure of Psycho-social Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.44	To what extent is an "Index measuring the extent to which the woman is involved in day to day decisions around the household, including her own health-seeking" a good measure of Psycho-social Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.45	To what extent is "Patient-rated availability of privacy at the closest health facility" a good measure of Psycho-social Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.46	To what extent is "Patient-rated staff attitude at the closest health facility (imputed values based on sample)" a good measure of Psycho-social Accessibility in this context? Sliding scale between "Very poor measure" and "Very good measure"
Q2.47	*[If the sliding bar gives a different answer to the ranking]* You scored [this variable] better than [that variable] despite picking [that variable] as the best measure in the question above. Why is this?
Q2.48	Can you think of a better variable to measure Psycho-social Accessibility, and for which data would be available in Zambia, that is not in the list?

SECTION 3	
READ OUT	*Because my research seeks to describe and explain inequalities, I also need to define a set of demographic characteristics that would be likely to predict disadvantage in maternal healthcare access in Zambia. I call these characteristics "identities", and I am planning to work with the following:* *education, wealth, age, residence, ethnicity, religion, marital status, parity*

Q3.1	Can you think of any other relevant identity variables from the 2013-14 Demographic Health Survey for Zambia? If so, how does this identity variable predict disadvantage in terms of healthcare access?
Q3.2	Are there members of specific ethnicities that are particularly disadvantaged in terms of maternal healthcare access? If so which ones?
Q3.3	Are there members of specific religions that are particularly disadvantaged in terms of maternal healthcare access? If so which ones?
Q3.4	Thinking of women with different levels of education, are women without a certain level of education particularly disadvantaged in terms of maternal healthcare access? If so, what is this threshold level below which they are disadvantaged?
Q3.5	Thinking of women in different age groups, are women in certain age groups particularly disadvantaged in terms of maternal healthcare access? If so which age groups?
Q3.6	Thinking of women living in different environments (capital city, small city, town, or countryside), are women living in certain environments particularly disadvantaged in terms of maternal healthcare access? If so which environments?
Q3.7	Thinking of women with different types of marital status (single, married, divorced, or widowed), are women with certain types of marital status particularly disadvantaged in terms of maternal healthcare access? If so which types of marital status?
Q3.8	Thinking of women with different numbers of children, are women with or without a certain number of children particularly disadvantaged in terms of maternal healthcare access? If so which number of children?

Key Informant information sheet

"Inequalities of maternal health in Zambia"

Laura Sochas, London School of Economics

Who I am
My name is Laura Sochas. I am a PhD student from the London School of Economics in the UK. I am conducting this research for my PhD and for academic publication. This research is not for commercial purposes.

What this research is about
My PhD research title is*: "To what extent can concurrent barriers and intersecting identities explain health inequalities? Evidence from maternal health In Zambia".*

My research abstract is: Despite growing prioritisation of health equity in low-income countries, efforts to improve health equity by removing a specific barrier to health care access have often failed. A common but untested hypothesis to explain these null or negative findings is that removing a single barrier to care has a stronger effect for those suffering from fewer other barriers. Focusing on maternal health in Zambia, this mixed methods study will:

Empirically investigate the extent to which any multiplicative effect of concurrent access barriers and intersecting identities is relevant for explaining current inequalities in maternal health care access and outcomes, using DHS data linked to geo-referenced health facility data.
Conduct a causal inference analysis to investigate whether removing a single access barrier benefits those facing fewer other access barriers the most, in terms of both access and outcomes.
Explore the mechanisms through which intersecting identities affect women's experiences of care-seeking in pregnancy and childbirth, through in-depth interviews.

Why I am conducting this interview
I am conducting key informant interviews with 10-15 experts in the policy and healthcare sectors for maternal health in Zambia. The aim is to design the most appropriate conceptual framework for the Zambian context, and to ensure that I select the best indicators to measure the key concepts.

What this interview will involve
The interview should take about an hour, and will consist of answering questions verbally and using an app. The interview will be audio recorded, with your permission.

Right to withdraw consent
You can choose to stop participating at any time during the interview, for whatever reason. You can also withdraw consent at any time after the interview.

Confidentiality and anonymity
As a default, I will make your contributions anonymous, meaning that I will not reveal your identity when quoting or acknowledging your contributions in my research. Please assist me in this by telling me which details about your professional status may or may not be disclosed to preserve anonymity. However if you prefer your participation and your specific contributions to be acknowledged, this is possible. I have no preference and this is entirely up to you. In any case, your contact details,

answers captured on the app, and transcript of the interview will not be accessible by anyone except for me.

Contact information

For additional information about the research or to withdraw consent:

Laura Sochas

Zambian telephone: 096 4413 493 (only in use when I am in Zambia)

UK telephone and whatsapp: 004478 1055 2358

Email: l.sochas@lse.ac.uk

Post: Department of Social Policy, London School of Economics

Houghton Street, London WC2A 2AE

UK

For any complaints regarding my ethical and professional conduct:

UNZABREC

Telephone: 02601256067

E-mail: unzarec@unza.zm

Post: University of Zambia

Ridgeway Campus

P.O. Box 50110

Lusaka, Zambia

Assurance No. FWA00000338

IRB00001131 of IOR G0000774

Ethics approval reference: 20th June 2017, ref: 005-06-17

Key Informant consent form

"Inequalities of maternal health in Zambia"

Laura Sochas, London School of Economics

Please tick the appropriate boxes	**Yes**	**No**
Taking Part		
I have read and understood the project information sheet dated 07/07/2017	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree to take part in the project. Taking part in the project will include being interviewed, answering questions using an app provided by the researcher, and being audio recorded.	☐	☐
I understand that my taking part is voluntary; I can withdraw from the study at any time and I do not have to give any reasons for why I no longer want to take part.	☐	☐
Use of the information I provide for this project only		
I understand my personal details such as phone number and email address will not be revealed to people outside the project.	☐	☐
I understand that my words may be quoted in publications, reports, web pages, and other research outputs.	☐	☐
*Please choose **one** of the following two options:*		
I would like my real name and professional identity used in the above	☐	
I would **not** like my real name to be used in the above. I have told Laura how to portray my professional identity in order to preserve anonymity	☐	
So I can use the information you provide legally		
I agree to assign the copyright I hold in any materials related to this project to Laura Sochas.	☐	☐

_____		_____	_____
Name of participant	[printed]	Signature	Date
_____		_____	_____
Researcher	[printed]	Signature	Date

Laura Sochas

Zambian telephone: 096 4413 493

UK telephone and whatsapp: 004478 1055 2358

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IRB00001131 of IOR G0000774

Thesis Appendix 3. In-depth interviews: data collection forms

Final in-depth interview guide

SECTION 1

Tell me about yourself:
- your children…
- what you do…
- where do you live (always lived there? What kind of place is it? How far from the clinic?)
- who do you live with (Do you get along? did they help with the pregnancy/birth? How?)…
- your friends/free time/community groups…

CHECK! DID SHE MENTION: her age, her education, what she does for work, what her husband does for work, where she lives, is she married, how many births she has had?

SECTION 2 – SHOULD TAKE AT LEAST 20 MINS

Now I would like to hear about your own experience and feelings during pregnancy and childbirth, from the moment you found out you were pregnant until after the baby was born. Please tell me everything that comes to your mind and that you would like to share. There is no right or wrong answer. Everything that is important to you is important to me. It is your story to tell. Let's start from how you found out you were pregnant.

[MAKE SURE SHE TELLS YOU ABOUT PREGNANCY, EARLY LABOUR, DELIVERY AND POST-DELIVERY]

Probes about story

- WHY?/WHAT HAPPENED THEN?/ANYONE ELSE?
- How did you feel about…
- Were you worried about…
- How did you expect/imagine…
- How did your husband/family feel about…
- How did people treat you…
- Who decided to…
- Who was there? What did they do?
- What were the other women like? Were there some you liked/disliked?
- What were the health workers like? Were there some you liked/disliked? Did they make you feel better? How?
- I've heard that…
- What do you think about women who…
- What do people say about women who…

Key topics

- Fear of caesars
- Being strong – what does it mean? Why is it important?
- SMAGs
- Health workers
- Traditional medicine
- Plans for delivery
- Delivering at home
- Finding money
- Fines
- Role of mothers
- Relationships with husband and friends – how did this affect her experience?
- Mothers' waiting shelters
- How do they know what they know about pregnancy and childbirth?

SECTION 3

Overall, how did your husband (or family) feel about how the pregnancy or birth went? Were they unhappy about anything? Why? How did you know they were unhappy (were they unhappy with **you**)? Were they unhappy with [INSERT SOMETHING SHE MENTIONED EARLIER)

Were the health workers happy or unhappy with you? How could you tell? Why do you think that was? Were they unhappy with [INSERT SOMETHING SHE MENTIONED EARLIER)

What was the best thing about your pregnancy and birth experience? What was the worst thing about your experience? …And apart from the pain? What would you change about your overall experience, if you could?

SECTION 4

Some women in pregnancy or childbirth might feel **afraid, ashamed, angry or depressed**. What kind of pregnancy or birth experience might make them feel this way?

Probe: aside from medical difficulties, what else?

What kind of women are most likely to have that experience [REFERRING TO ANSWER ABOVE]? What do people say about them?

You said _____X____ women were likely to have a bad birth experience. What if this woman was _____X____ **and** [*positive characteristic*], would she also be likely to have a bad birth experience? Why or why not?

SECTION 5

Now I am going to tell you some women's stories, and I would like you to imagine what sort of pregnancy and birth experiences they might have:

PICK TWO VIGNETTES AND READ THEM OUT

Who, of : **A** or **B** would be more likely to feel afraid, ashamed, angry or depressed in pregnancy or birth? Why?

What if **A** was _____? Would she have felt differently? How?
What if **B** was _____? Would she have felt differently? How?

In-depth interviews information sheet

Maternal health inequalities study

Information Sheet

Who we are
My name is_____. I normally live in Lusaka. I am assisting a researcher from England, Laura Sochas, by asking people questions, writing down what they said, and translating what people say into English.

Laura is a researcher and a student from a university in England called the London School of Economics. She normally lives in London, in England and she speaks English but no Bemba.

What this research is about
I would like to hear the story of how you gave birth to your last baby. Laura is interested in what you have to say because women in Zambia have different experiences of childbirth. Thanks to the information you give us, she is hoping to understand why some women give birth to their baby in health facilities others give birth in other places. She will use this information for her studies and to write academic articles.

Do you have any questions?

Here are some of the questions that other participants have asked:

Do I have to say yes to talking to you? No, it is your choice. No one will mind if you choose not to speak with me. You can also change your mind at any time after saying yes.

If I participate, what would I have to do? I will ask you some questions. Normally this takes about one hour. You do not have to answer any question you don't want to and you can stop and leave at any time if you feel like it, without giving a reason.

What if my baby starts to cry, or I need to breastfeed? You can decide what to do – if you prefer, we can pause the interview and I can leave the room; or you can feed the baby during the interview. It is your choice.

Will our conversation be recorded? Yes, if you agree. This will help me make precise notes of what you said, so we can compare this with other women's stories. Most people who participate forget the recorder is there.

Will I lose my place in the line for the immunization clinic? No. We have an arrangement with the nurses so that your place in the queue will be kept for when you come back.

Where will we speak? We have arranged a quiet spot where no one else can hear what we are saying.

Will I get paid for my time? No.

Will you tell anyone what I said? Laura will share your words (in written form) through a website, for other researchers to use. She will also use those words in publications. However no one but

Laura and myself will not know who said those words. This is because we will not give anyone else your real name, where you live, or any other information that people could use to find out who you are.

Are you working with the health facility? The health facility staff know we are doing this research and why, but we are not working with them. They will not have any information about what you said.

After I have left, how can I contact you with questions or to tell you I no longer want you to use my information?

Please contact us at:

Laura Sochas
Zambian telephone: 096 4413 493
UK telephone and whatsapp: 004478 1055 2358
Email: l.sochas@lse.ac.uk
Post: Department of Social Policy, London School of Economics
Houghton Street, London WC2A 2AE
UK

Research assistant name:_____

Zambian telephone:_____

Email: _____

What if I am unhappy about the way I have been treated by you or by Laura?
You can contact the University of Zambia Bio-Medical Research Ethics Committee (UNZABREC) to make a complaint. They are independent and their role is to make sure researchers do what is right.

UNZABREC
Telephone: 02601256067
E-mail: unzarec@unza.zm
Post: University of Zambia
Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia
Assurance No. FWA00000338
IRB00001131 of IOR G0000774

In-depth interviews self-completion consent form

Self-Completion Consent form

Interview ID: _____|_____|_____

Please tick the appropriate boxes

	Yes	No
Taking Part		
I have read and understood the research information sheet dated 14/05/2018	☐	☐
I have been given the opportunity to ask questions.	☐	☐
I agree to take part in the research. Taking part in the research will include answering questions and these answers being recorded with a microphone.	☐	☐
I understand that participating is my choice. I can decide to stop taking part at any time, without giving my reasons.	☐	☐
Use of the information I provide		
I understand that no one, apart from Laura and _____, will know my name, where I live, or other personal details.	☐	☐
I understand that my words may be shared and may be publically available, such as: in publications, reports, web pages etc.	☐	☐
I understand that other researchers apart from Laura and _____ will have access to my words and may use them, but they will not know who said those words.	☐	☐
So we can use the information you provide legally		
I agree to assign the copyright I hold in any materials related to this project to Laura Sochas.	☐	☐

_____ _____ _____

Name of participant [printed] Signature Date

_____ _____ _____

Researcher [printed] Signature Date

In-depth interviews oral consent form

Oral Consent form

Interview ID: _____|_____|_____

Read out questions below and tick the appropriate boxes according to what the respondent says:

	Yes	No
Taking Part		
Do you have any questions at all about the research?	☐	☐
To check that we have explained everything clearly to you, can you explain to me whether we will tell anyone what you have said?	☐	☐
Do you agree to take part in the research, by answering questions and being recorded with a microphone?	☐	☐
As we have explained, you can stop answering questions and leave at any time without giving a reason. We would like to practice this with you now if you don't mind, to make sure you are comfortable. Can you pretend to end the interview now?	☐	☐
Use of the information you provide		
Please tell me the only people who will know your name, your address and your personal details.	☐	☐
Do you understand that your words may be shared and may be publically available, such as: in publications, reports, web pages?	☐	☐
Do you understand that other researchers apart from Laura and [name of research assistant] will have access to your words and may use them, but they will not know who said those words?	☐	☐
So we can use the information you provide legally		
Do you agree to allow Laura Sochas to use your words as discussed in the information sheet and just now?	☐	☐

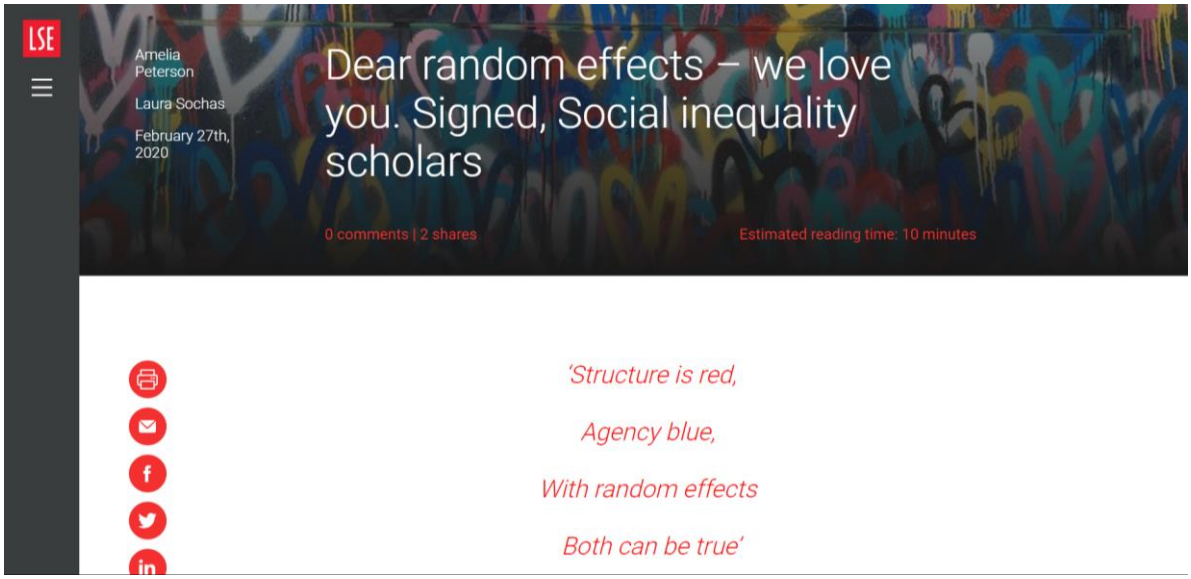
I hereby certify that the respondent has provided informed oral consent:

_____
Name of respondent [printed]

_____ _____ _____
Researcher [printed] Signature or thumb print Date

Thesis Appendix 4. Examples of dissemination work

Blog based on Paper 1 of the thesis, co-written with Amelia Peterson



Chances are that if you know about random effects, you use them a lot in your research. Alternatively, you could be a quantitative social scientist with only the vaguest idea about their application. Beloved of social statisticians, derided by economists, random effects are absent from most foundation-level courses in applied quantitative analysis in the social sciences. As social inequality scholars (in health – Laura Sochas; in education – Amelia Peterson), we believe they are incredibly helpful to quantitatively study the age-old agency versus structure debate. We also argue that new applications and existing properties of random effects are still underused and hold great promise for the study of social inequalities.

For those unfamiliar with random effects, this is the elevator pitch introduction. Multilevel models, as their name indicates, allow for the quantitative study of variables at multiple levels - individuals nested in schools; households nested in regions; patients nested in hospitals, etc. Fixed effects multilevel models handle the effect of being part of that group or structure as something to control for in order to reduce bias in estimating the effect of individual-level characteristics on the outcome of interest. Random effects, in contrast, extract substantive information from the group-level term regarding how important group membership is, enable the inclusion of group-level characteristics in the model as well as group membership, and, using random slopes, allow the effect of individual characteristics to vary across groups.

Because of this, random effects are the perfect set-up for analysing social inequalities. You are explicitly modelling social beings, such as children, doctors, students, employees, within their social structure, be that a family, a firm, a school, a health service's catchment area, a neighbourhood, or a country. In studying inequality, we know that "structure" does not just mean buildings or formal organizations: different institutional or material conditions can have different effects, depending on a person's position in, for example, a social hierarchy. Random effects are ideal for answering questions such as: "How much of the disparities in educational achievement can be explained by school membership?"; "Which schools are best at dialling down the effect of disadvantaged social origins on

education achievement?"; "What level of social structure is most important in shaping health outcomes? Family, neighbourhood or GP catchment area?". All of this analysis is powered by the quantification of individual-level variability between groups versus within groups. While there is a strong tradition of this research method in education (allowing us, for example, to study how "school effects" vary by group and different compositional features), it is less often applied in other social policy fields.

Recent publications demonstrate exciting innovations for the application of random effects in social inequality research. One of these is called MAIHDA: Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy. The core idea behind MAIHDA is that random effects can be used to determine whether the social structure (e.g. neighbourhoods) has predictive power for the outcome of interest. Clare Evans has pioneered the use of MAIHDA in the context of intersectional health inequalities analysis. Instead of nesting individuals within tangible social structures, she nests them within more abstract but highly influential overlapping axes of discrimination and privilege, such as race, gender, income, and age. This offers a highly innovative and efficient quantitative method to evaluate intersectionality hypotheses first developed and evidenced by American Black feminist scholars such as Kimberle Crenshaw in the 1980s. In the case of intersectional MAIHDA, each individual is nested within his or her relevant intersection: e.g. Hispanic, female, young, and middle class; or White, male, old and poor. A random effect is defined at that intersectional membership level. By adding fixed variables measuring each categorical membership to the model (e.g. a variable for gender, a variable for race, etc), which controls for additive effects, the variance of the random effects is interpreted as the multiplicative effect of intersectional membership (see here for a recent critical discussion of necessary assumptions).

In a recent paper exploring maternal healthcare access inequalities in Zambia, Laura Sochas draws inspiration from these novel approaches to imagine another abstract but important social environment, which she calls health service environments. Instead of defining these solely geographically, such as a health facility's catchment area, she combines different geographic characteristics of the health service environment (geographic access to any health facility, to a midwife, and/or to a hospital capable of conducting Caesarean sections), with social characteristics we know are discriminated against in the Zambian health system (being poor, having many children). Individuals are nested within these multidimensional health service environments, which combine important geographic and social aspects. Thanks to MAIHDA, it is possible to establish whether health service environments have the power to accurately predict which women will suffer from particularly low access, and to identify which dimensions of the health service environment have higher predictive power. Under a progressive universalism approach, where the worst off are prioritised for public investment, this approach could be an important asset in combatting social inequalities.

The ability to contextualise individuals within their social structure is what we love most about random effects. Recent innovations point to the possibility of imagining aspects of social structures that are no less important for being intangible. With these approaches, quantitative methods can increasingly catch up with the sophistication of theory when it comes to understanding the processes that create and reproduce inequalities.

Policy brief for policy stakeholders in Zambia, based on Paper 3 of the thesis

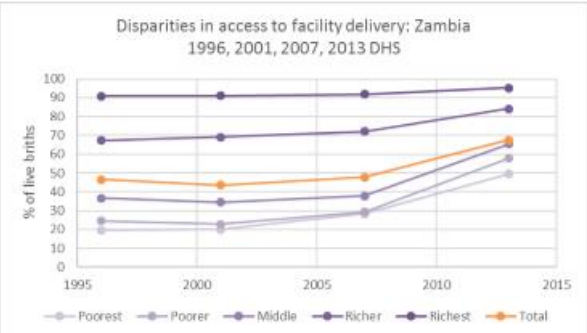
Policy Brief:
Facility Rules and Maternal Health Inequities

Key Findings

- Women are told to follow a range of rules in pregnancy and childbirth by health workers
- Women who break the rules are punished by health facility workers and/or traditional authorities, through: fines, exclusion from healthcare, and/or disrespectful care
- Women who break the rules are also stigmatized by other lay people at the facility or in their community
- Poorer mothers and mothers without social support (especially unmarried mothers) struggle to meet these health facility rules
- The rules have negative consequences for disadvantaged women's mental and social wellbeing in pregnancy and childbirth

Introduction

While reducing health inequities is one of the Ministry of Health's policy priorities, the last available Zambia Demographic and Health Survey (2013-14) shows that the absolute difference between facility delivery rates among the rich and the poor was almost 50 percentage points in 2008-2013.



This policy brief summarises qualitative research conducted as part of a doctoral study, which aimed to discover possible mechanisms behind maternal health inequities.

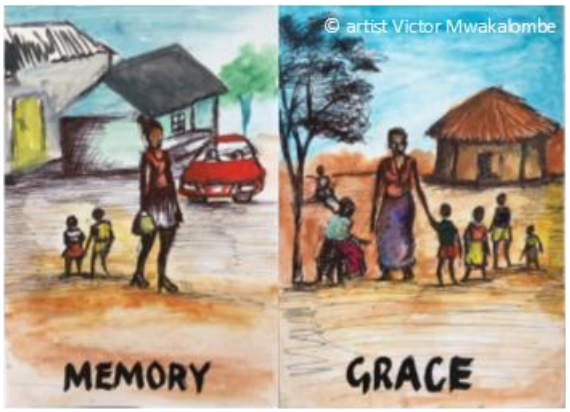
The full study can be freely accessed here: https://doi.org/10.1016/j.socscimed.2019.05.013

Methods

This research is based on 42 interviews conducted in Mansa district, Luapula Province, with women from a range of backgrounds who had given birth in the previous year. Participants were recruited and interviewed in the local language (Bemba) at nine immunization clinics in rural and urban locations. Interviewers asked women about their most recent pregnancy and birth experience and about which types of women might be more likely to have a positive or negative experience.

Findings

Respondents described health facility rules they had to follow during pregnancy and childbirth. 25 rules were documented, for example: giving birth at the facility; bringing materials to the facility for childbirth (e.g. plastic sheet, bucket, gloves, cord



Vignettes used in the course of interviews

clamp, nappies, chitenges); registering the pregnancy with the husband; doing only light work during pregnancy; etc.

Poorer mothers and mothers without social support (especially unmarried mothers) struggled to follow health facility rules. Many rules required financial resources (e.g.: bringing materials to the facility) or social support (e.g.: registering the pregnancy with the husband).

Some respondents described making financial sacrifices (borrowing on future wages to pay for transport to the facility) or physical sacrifices (working hard in the field during pregnancy) in order to follow the rules.

Disadvantaged women who were unable to follow all the rules felt guilty about putting their baby's health at risk, felt ashamed, and were stigmatized or punished by health workers and other community members. Punishments included: fines; being excluded from accessing healthcare; being shouted at; being ridiculed; being threatened with a C-section; etc.

In order to receive exemptions, women had to reveal stigmatising details about their private life to persons in authority (e.g. being left by one's husband in pregnancy). The rules also reinforced strong social pressures to marry or to be submissive to parents, because of the fact that it was much harder to follow the rules without social support.

Where do the "rules" come from?

There are many other studies documenting these rules in Zambia (see the appendix to the published article). While the research did not focus on the origin of the rules, anecdotal evidence suggests that the rules are not imposed by the Ministry of Health through formal policies. Furthermore, the national Government has condemned some of these practices in the past.

However, the Government of Zambia has put in place accountability systems that put pressure on the provincial and district health offices and front-line health workers to achieve safe motherhood objectives. It is likely that donors also exercise pressure around these quantitative targets. Evidence from other countries suggests that the rules are least partly driven by these accountability systems.

Policy recommendations

1. Allocate sufficient resources to the district and health facility levels for them to provide all required materials to women for childbirth (including support for nappies and chitenges)
2. Include patient reported outcomes in accountability processes, disaggregated by socio-economic status and marital status, e.g.:
    - % of women who delivered in a health facility who agreed with the statement: 'the health staff are courteous and respectful'; % of women who felt they had sufficient financial or social support in pregnancy; % of women who felt worried about financial and/or logistical preparations for pregnancy and childbirth. (This data should not be collected by health workers)
3. Understand *how* quantitative objectives are achieved at province, district and facility levels, and establish a regular dialogue about what are acceptable vs. unacceptable strategies
4. Incorporate equity awareness training into health workers' pre-service education (esp. nurses and midwives), for health workers to better understand and redress stigmatizing behaviours
5. Reflect further on how the rules advantage some women over others, through soliciting disadvantaged women's perspectives, and change inequitable rules

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Article: https://doi.org/10.1016/j.socscimed.2019.05.013

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