Demographic and Health Effects of the 2003–2011 War in Iraq

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Declaration of authorship

I certify that the thesis I have presented to the Department of Social Policy of the London School of Economics and Political Science for examination for the PhD degree in Demography 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).

The main findings of this thesis have been published in peer-reviewed journals. The references to these articles are:

Cetorelli V. (2014) The effect on fertility of the 2003–2011 war in Iraq. *Population and Development Review*, 40(4): 581–604.

Cetorelli V. (2015) The impact of the Iraq War on neonatal polio immunisation coverage: a quasi-experimental study. *Journal of Epidemiology and Community Health*, 69(3): 226–231. First published online on 23 Nov 2013.

Cetorelli V. and Shabila N. P. (2014) Expansion of health facilities in Iraq a decade after the US-led invasion, 2003–2012. *Conflict and Health*, 8: 16.

The main findings of this thesis have also been covered by over 20 media outlets, including *An-Nahar*, *Iran Daily*, *Middle East Health Magazine*, *Eurasia Review*, *Europa Press*, *Spektrum der Wissenschaft*, *Women's eNews*, and *Stop Violence Against Women*.

Abstract

The increasing international concern about the consequences of warfare for civilian populations has led to a growing body of demographic and health research. This research has been essential in providing estimates of war-induced excess mortality, a primary indicator by which to assess the intensity of wars and the adequacy of humanitarian responses. Far less attention has been paid to war-induced changes in fertility and population health, and the limited existing literature has rarely adopted a longitudinal approach. This is especially evident in the case of the 2003–2011 war in Iraq. Several studies have sought to quantify excess mortality, whereas other demographic and health effects of this war have been largely overlooked.

This thesis fills substantive knowledge gaps using longitudinal data from the 2000, 2006 and 2011 Iraq Multiple Indicator Cluster Surveys (I-MICS). The data collected during wartime are found to be of similarly good quality as those collected during peacetime. The analysis shows that, besides causing a heavy death toll, the Iraq war also had profound long-term consequences for women and newborns. It provides the first evidence on the effect of the war on early marriage and adolescent fertility, with implications for women's empowerment and reproductive health. It is also the first to quantify the effect of the war on neonatal polio immunisation coverage, with relevance for the recent polio outbreak. It finally assesses the main challenges to Iraq's health sector rehabilitation efforts, namely the ongoing insecurity and persistently high rate of population growth. Overall, the findings have important documentation functions for the international community and serve as inputs for the design of humanitarian relief strategies in Iraq and similar war-torn countries, such as neighbouring Syria.

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For my mother, who has given me everything.

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List of acronyms

ASFR: Age-Specific Fertility Rate

IBC: Iraq Body Count

I-FHS: Iraq Family Health Survey

I-LCS: Iraq Living Conditions Survey

I-MICS: Iraq Multiple Indicator Cluster Survey

OECD: Organisation for Economic Cooperation and Development

OPV: Oral Polio Vaccine

ORB: Opinion Research Business

PHCC: Primary Health Care Centre

TFR: Total Fertility Rate

UN: United Nations

UNDP: United Nations Development Programme

UNICEF: United Nations Children's Fund

WHO: World Health Organisation

CHAPTER I. Introduction

1.1 Demographic and health effects of war: review of research and knowledge gaps

The need for more research on the demographic and health effects of war has been widely acknowledged by demographers, epidemiologists, public health practitioners and human rights activists (Brunborg and Tabeau 2005; Brunborg and Urdal 2005; Burkle 2006; Thoms and Ron 2007; Guha Sapir and D'Aoust 2010; Rezaeian 2015). Growing efforts have been devoted to estimating mortality in recent wars. By contrast, war-induced changes in fertility and population health have received little attention. This introductory section reviews the current status of research and highlights some critical knowledge gaps.[1] The remainder of the thesis addresses these gaps focussing on the 2003–2011 war in Iraq.

Mortality effects of war

The most commonly used definition of war refers to fighting causing at least 1,000 battle-related deaths per year among civilians as well as military personnel (Eck 2005; Sarkees 2010). While military casualties have been recorded for many decades, accounts of civilian deaths have only recently begun to appear with regularity, reflecting the increased attention to the plight of civilian populations caught in war (Seybold, Aronson and Fischhoff 2013).

Assessing the extent of war-related mortality among civilians has advocacy, programmatic, judiciary and documentation functions (Checchi and Roberts 2008). Mortality estimates are critical to grade the severity of a war and adjust humanitarian relief operations accordingly. For example, surveys estimating war-related deaths in the

[1] The review refers to research covering residents of war zones, that is people who did not leave their places of habitual residence during war. They account for nearly 90 per cent of war-affected people worldwide. Those who fled their homes are classified as internally displaced or refugees depending on whether they have crossed an internationally recognised state border (Centre for Research on the Epidemiology of Disasters 2013).

Democratic Republic of Congo were widely reported by international media and led to a doubling of humanitarian aid (Roberts et al. 2001; Checchi and Roberts 2005). Mortality estimates are also used as evidence in international courts of justice in the case of genocides and crimes against humanity, and serve as historical records for posterity and reconciliation processes. An example is the important role of expert testimonies by demographers at the International Criminal Tribunal for the former Yugoslavia (Brunborg 2003; Brunborg, Lyngstad and Urdal 2003).

Research on war-related mortality entails a comparison with a baseline mortality that would have prevailed in case of peace. Since this baseline is unobservable, the impact of war is disentangled by analysing mortality before and during war, and comparing that either to a "control" population with similar characteristics but unaffected by the war or to other counterfactual assumptions about what mortality trends would have been had the war not occurred (Daponte 2007).

Complete vital registers would be the gold standard data source for carrying out such comparisons. However, registration systems typically fall apart during war, and many wars occur in places without pre-existing surveillance infrastructure (Obermeyer, Murray and Gakidou 2008). Two alternative techniques are thus used to gather mortality estimates: passive reports and retrospective household surveys.

Passive reports are essentially a compilation of documented deaths derived from media agencies and official sources, including mortuaries and health facilities (Checchi and Roberts 2008). Since a significant number of deaths in war zones may remain undocumented by the media and official sources, most studies rely on retrospective household surveys for a more comprehensive account of war-related mortality. In these surveys, a representative sample of households is interviewed about deaths that occurred within the household over a specified period before and during war. This information is used to compute mortality rates and describe causes of deaths. The findings are then generalised to the total war-affected population to estimate the overall death toll attributable to the war (Ratnayake et al. 2008).

Several mortality studies have been conducted during recent wars using retrospective household surveys. See for example Spiegel and Salama (2000) for Kosovo, Roberts et al. (2001), Roberts et al. (2003), and Coghlan et al. (2006) for the Democratic Republic of Congo, Depoortere et al. (2004), Hagan and Palloni (2006), and Degomme and Guha-Sapir (2010) for Darfur; and Roberts et al. (2004), Burnham et al. (2006), Alkhuzai et al. (2008), and Hagopian et al. (2013) for Iraq. Their mortality estimates have received wide scientific and public attention, stimulating further research efforts and methodological refinements (Working Group for Mortality Estimation in Emergencies 2007).

Public health effects of war

Less attention has been paid to the impact of war on public health, that is all organised interventions to prevent diseases, promote health and prolong life among the population as a whole (WHO 2015). Disruption of powerful and cost-effective public health interventions, such as routine newborn immunisation, may have devastating consequences for civilians caught in war.

Research on the public health effects of war has important advocacy and programmatic functions. For example, the disruption of routine newborn immunisation services during the Bosnian war left a great number of children unvaccinated. This resulted in repeated outbreaks of vaccine-preventable diseases for several years after the war (Hukic et al. 2012; Obradovic et al. 2014). Such research has also judiciary and documentation functions, especially when the delivery of public health services in war zones is denied wilfully by political leaders. An example is the systematic and widespread obstruction of humanitarian assistance by the Khartoum government during the Sudanese civil war, which has been described as falling within the ambit of crimes against humanity (Reeves 2011).

Assessing the extent to which a war has affected the delivery of public health services involves disentangling changes attributable to the war against a baseline scenario of peace. As for war-related mortality, a comparison can be made with the period immediately before the war, using a "control" population with similar characteristics but unaffected by the war or other counterfactual assumptions about what public health trends would have been had the war not occurred. In the absence of reliable health surveillance systems, retrospective household surveys collecting health indicators for a period spanning before and during war can be used for carrying out such comparisons. However, survey-based research adopting a comparative longitudinal approach equivalent to that of mortality studies has remained scant (Guha Sapir and D'Aoust 2010).

A few studies have provided estimates of immunisation coverage in war zones. See for example Robertson et al. (1995) for Bosnia, Agadjanian and Prata (2003) for Angola, and Senessie, Gage and von Elm (2007) for Sierra Leone. However, lack of longitudinal data prevented these studies from determining the extent to which poor immunisation coverage was attributable to war-related disruption or to pre-existing trends. More robust and informative assessments could have been carried out if retrospective immunisation histories were collected for a period spanning before and during war. A further limitation of these studies is the lack of attention to potential undermining effects of war on survey data quality. The reliability of their estimates would have been strengthened by a detailed evaluation of data quality, for example through a comparison with a preceding or consecutive survey (see chapter IV).

Fertility effects of war

Research on war-induced fertility changes and reproductive health issues more broadly is also scarce, although the need to monitor women's status in war zones has been increasingly acknowledged. Depending on the context, such research should include issues of sexual violence, early and forced marriage, sexually transmitted diseases, and unwanted pregnancies among others (McGinn 2000; McGinn and Purdin 2004; Patel et al. 2009).

As for the mortality and public health effects of war, assessing changes in fertility and reproductive health in war zones has critical advocacy and programmatic functions. The World Health Organisation has explicitly recognised that reproductive health for civilians experiencing the trauma of war ought to be considered as much a human right as the basic essentials of shelter, food, water and sanitation (WHO 2000; 2010). In case of war crimes, research on fertility and reproductive health issues has also judiciary and documentation functions. An example is the dramatic scope of sexual violence, and resulting unwanted pregnancies and spread of HIV and other sexually transmitted diseases, during the Rwandan genocide (Farewell 2004; Aginam 2012).

Identifying changes in fertility and reproductive health resulting from a war may be more complex than assessing changes in mortality and other public health indicators. The reason is that war is likely to alter fertility trends in multiple, and possibly countervailing, ways (Guha Sapir and D'Aoust 2010). An effective strategy to isolate the multiple effects of war is to decompose changes in fertility into the main biological and behavioural factors underlying them (Hill 2004). In the absence of reliable vital registers, birth histories from retrospective household surveys can be used to retrace trends in fertility and its main underlying factors for a period spanning before and during war.

A few studies have assessed fertility and reproductive health issues in war zones using birth history data. See for example Lindstrom and Berhanu (1999) for Ethiopia, Agadjianian and Prata (2002) for Angola, and Blanc (2004) and Woldemicael (2008) for Eritrea. The lack of research on recent wars, especially those affecting the Middle East since the early 2000s, constitutes a major knowledge gap. Additionally, as in the case of immunisation studies, the existing fertility studies have not paid sufficient attention to data quality issues. Birth history data can suffer from various problems, including omission and displacement of births, that may be exacerbated during wartime. It is therefore critical to ascertain the reliability of these data, possibly through a comparison of multiple retrospective household surveys (see chapter III).

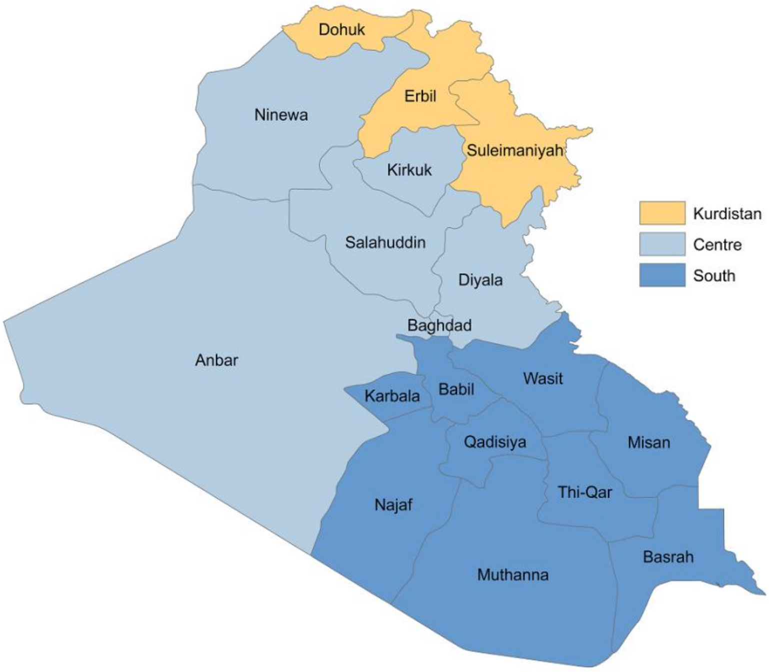
1.2 Contributions and structure of this thesis

The research gaps highlighted above are especially evident in the case of the 2003–2011 war in Iraq. Six major survey-based mortality studies have been conducted throughout the course of this war (Roberts et al. 2004, UNDP 2005; Burnham et al. 2006, Opinion Research Business 2007; Alkhuzai et al. 2008, Hagopian et al. 2013), whereas the effects on fertility and public health have been largely overlooked. The reminder of the thesis fills these research gaps using longitudinal data from three Iraq Multiple Indicator Cluster Surveys. The findings serve as important records for the international community and are relevant for the design of humanitarian relief strategies in Iraq and similar war-torn countries, such as neighbouring Syria.

The setting

Situated in the heart of the Middle East, Iraq borders Iran to the East, Turkey to the North, Syria and Jordan to the West, and Saudi Arabia and Kuwait to the South. It has an estimated population of approximately 35 million and is administratively divided into 18 governorates, as seen in figure 1.1. The central and southern governorates are under the authority of Baghdad's Central Government, while the three northern Kurdish governorates are administered by an autonomous Kurdistan Regional Government (Kirmanj 2013).

Figure 1.1 *Iraq's 18 governorates and their regional classification*



Recent demographic and health trends in Iraq must be seen against the country's turbulent history since the inception of Saddam Hussein's regime (Dyson 2006). Saddam Hussein became president of Iraq in 1979. One year later, he launched an invasion of the oil-rich Iranian province of Khuzistan. The invasion was an attempt to neutralise the threat posed by the leadership of Ayatollah Khomeini, who soon after the Iranian revolution had called for the Iraqi Shiite population to overthrow the secular nationalist regime in Iraq (Dodge 2013). The invasion failed to achieve the quick victory that Saddam Hussein had anticipated, leading instead to eight years of conventional warfare. Although most of the fighting occurred away from populated areas, during the last year of this war Iraqi forces used poison gas against the Kurdish town of Halabja, which had been seized by the Iranians (Kelly 2009).

Despite the war, the socio-economic and health conditions of Iraq’s population did not deteriorate during the 1980s. Saddam Hussein's regime mixed political repression of its people with efforts to improve their social welfare. Along with building a ruthless internal security apparatus, the regime used revenues from the nationalised oil industry to extend roads, electricity grids, water purification systems and health care infrastructure (Etheredge 2011). However, the war against Iran left Iraq heavily indebted to the Arab Gulf States, and this was one of the factors that moved Saddam Hussein to seek the country’s economic recovery through the annexation of Kuwait just two years later (Cleveland and Bunton 2009).

The invasion of Kuwait in August 1990 led to the immediate imposition of a strict economic embargo by the UN Security Council (United Nations 1990). During the Gulf War that followed, US-led coalition forces subjected Iraq to intensive air bombardment in a military offensive that lasted only a few weeks but destroyed or disabled virtually the entire infrastructure of the country. Soon after the cease-fire, the regime faced two internal uprisings, among the Shiites in the south and the Kurds in the north. While the Shiite rebellion was violently suppressed, the Iraqi army had to withdraw from the three Kurdish governorates, leaving them to be administered as an autonomous region under UN auspices (Cleveland and Bunton 2009). The UN embargo was maintained and extended after the Gulf War, the main condition for its removal being the dismantling of all weapons of mass destruction. The only imports permitted into Iraq were food, medicine and other items classified as humanitarian aid (Weiss 1997).

Although economic sanctions have been instigated against several countries in the last few decades, it is difficult to think of any country more vulnerable to this type of sanctions than Iraq. With 95 per cent of the funds for the national budget and 65 per cent of the GDP generated by oil exports, prior to 1990 Iraq was highly dependent on international trade for a wide range of essential goods. Moreover, the economic embargo against Iraq was the most comprehensive ever imposed on a country. Living conditions deteriorated dramatically in all aspects, including food availability, water supply, sanitation and health care (Garfield 1999).

An Oil-for-Food Programme was approved by the UN Security Council in 1995, allowing Iraq to sell oil to purchase humanitarian supplies under UN supervision (United Nations 1995). As a result, there was some limited improvement in living conditions. The amount of food provided each month to households through the public distribution system increased somewhat during the late 1990s. Saddam Hussein's regime also became eventually more adept at circumventing the sanctions through covert oil sales. Meanwhile, the United States and United Kingdom continued to carry out intermittent air attacks on Iraqi military and government targets suspected of being associated with weapons of mass destruction. The regime repeatedly declared that all proscribed weapons have been destroyed, but UN inspections were often obstructed (Etheredge 2011).

The situation would probably have evolved slowly, but the terrorist attacks on the United States on 11 September 2001 led to an abrupt change. Although no clear connection was proven linking Saddam Hussein's regime with the attacks, the US President George W. Bush singled out the complete disarming of Iraq as a renewed priority. US-led coalition forces invaded the country in March 2003, without explicit authorisation from the UN Security Council. By early May, Saddam Hussein's regime was removed from power and the coalition forces announced the completion of major combat operations (Marr 2012).

After the disintegration of Saddam Hussein's Baath party, a Coalition Provisional Authority assumed the governance of Iraq. However, the occupying forces failed to guarantee security, and politically motivated insurgency began in this early stage. Insurgents belonged to two distinct ideological groups: one pro-nationalist and another one more radically Islamist and sectarian (Hafez 2007). The latter deployed suicide bombing as one of their main weapons to target not only the occupying forces but also senior politicians, mosques and geographic areas associated with Shiite Islam. Shiite militias began to retaliate against Sunni communities. By the time the first general elections for a Transitional National Assembly were held in 2005, violence throughout the country had taken on an overtly sectarian tone with both sides using religious imagery to justify the struggle (Dodge 2013).

Living conditions failed to improve after the invasion, with most families still relying on the public distribution system for basic food items (Rawaf et al. 2014). The dire security situation hindered reconstruction and development efforts in virtually all sectors, including health care (see chapters IV and V). Widespread violence, combined with the resurgence of sectarian and other conservative forces, also led to a severe deterioration in women's status (see chapter III).

In 2006, Nuri Al-Maliki of the Shiite Islamic Dawah Party was nominated prime minister of a coalition government. The years that followed saw growing authoritarianism and consolidation of sectarian politics. Nuri Al-Maliki was nominated for a second term as prime minister in 2010, despite his party not having won the elections (Al-Ali 2014). With the American public support for the war having reached an all-time low, the new US president Barack Obama pledged that US forces would be withdrawn from Iraq by December 2011 (Holsti 2014). The departure of the last US troops is conventionally considered to mark the end of the Iraq War. However, violence and instability in Iraq have continued, being further fuelled by the outbreak of civil war in Syria (Lawson 2014).

Demographic and health effects of the 2003–2011 Iraq War

A large body of research has been devoted to assess the mortality effect of the 2003 US-led invasion of Iraq and its aftermath. The total death toll has proven difficult to measure and it is still a matter of considerable contention.

One of the sources most often cited is the so-called Iraq Body Count (IBC), a UK-based independent project providing a publicly accessible and daily updated database of violent civilian deaths in Iraq since 2003. The project was launched as an activist response to the statement "we don't do body count" by the US General Tommy Frank, who led the invasion of Iraq. The database is a compilation of deaths derived from media outlets and NGO-based reports, along with official records that have been released into the public sphere. From 2003 to 2011, a total of 119,359 violent civilian deaths were recorded (Iraq Body Count 2012). However, sensitivity analyses and capture-recapture assessments have shown that the IBC is incomplete and should be interpreted as a lower bound or minimum death toll rather than a best estimate (Siegler et al. 2008; Carpenter, Fuller and Roberts 2013).

Six retrospective household surveys were undertaken in an attempt to provide a more comprehensive account of war-related mortality in Iraq (see table 1.1). A first survey was carried out in 2004 by a team of American and Iraqi academics. The survey, consisting of 33 clusters of 30 households each, had a response rate of 99.3 per cent. Respondents were enquired about household composition, births and deaths since January 2002. The relative risk of death associated with the US-led invasion was assessed by comparing mortality in the 17.8 months after the invasion (March to September 2004) with the 14.6 months preceding it (January 2002 to March 2003). The data analysis, which was published in *The Lancet*, yielded an estimate of 98,000 excess deaths from March 2003 through September

2004, with a 95 per cent confidence interval of 8,000 to 194,000 deaths (Roberts et al. 2004).

An Iraq Living Conditions Survey (I-LCS) was also carried out in 2004. The survey was commissioned to the Norwegian Fafo research institute by the Iraqi Ministry of Planning and Development Corporation, in partnership with the United Nations Development Programme. The selected sample was much larger than that of the *Lancet* study, consisting of 2,200 clusters of 10 households each. Response rate was 98.5 per cent. This survey was not aimed primarily at estimating mortality; rather it collected a wide range of indicators on housing and infrastructure, household economy, demographic, health, education and labour force characteristics. Based on the number of persons recorded dead or missing due to violent causes in each of the interviewed households, the survey report estimated 23,743 war-related deaths from March 2003 through May 2004, with a 95 per cent confidence interval of 18,187 to 29,299 deaths (UNDP 2005).

A third survey consisting of 50 clusters of 40 households each was conducted in 2006 by some of the same authors of the 2004 *Lancet* survey. Three misattributed clusters were excluded from the final sample. In the remaining 47 clusters, household response rate was 98.4 per cent. The interviewed households were asked information on household composition, births and deaths since January 2002. The excess death toll was estimated by comparing mortality rates in the period before (January 2002 to March 2003) and after the invasion (March 2003 to July 2006). The data analysis, which was also published in *The Lancet*, estimated a total of 654,965 excess deaths from March 2003 to July 2006, with a 95 per cent confidence interval of 392,979 to 942,636 deaths. Consistent with the findings from the 2004 *Lancet* study, the analysis also provided an estimate for the period between March 2003 and September 2004 of 112,000 deaths, with a 95 per cent confidence interval of 69,000 to 155,000 deaths (Burnham et al. 2006).

A fourth survey was undertaken in 2007 by the British polling agency Opinion Research Business (ORB), in partnership with its Iraqi fieldwork agency. The survey, consisting of 112 clusters of 20 households each, yielded a response rate 87.2 per cent. An adult over the age of 18 in each household was asked the following question: “How many members of your household, if any, have died as a result of the conflict in Iraq since 2003 (i.e. as a result of violence rather than a natural death such as old age)? Please note that I mean those who were actually living under your roof.” The poll estimated that 1,220,580 war-related deaths had occurred from March 2003 through August 2007, with a 95 per cent confidence interval of 733,158 to 1,446,063 deaths (ORB 2007).

A fifth survey, known as the Iraq Family Health Survey (I-FHS), was conducted between 2006 and 2007 by the Federal and Regional Ministries in Iraq, and the Central Organisation for Statistics and Information Technology, with technical support from the World Health Organisation. The survey consisted of 1,086 clusters of 10 households each and had a response rate of 89.4 per cent. All deaths that occurred in the households from June 2001 to the time of the survey were ascertained. In the survey analysis, which was published in *The New England Journal of Medicine*, the mortality estimate was calculated for the same period covered by the 2006 *Lancet* survey (January 2002 to June 2006). The number of deaths due to violence from March 2003 through June 2006 was estimated to be 151,000, with a 95 per cent confidence interval of 104,000 to 223,000 deaths (Alkhuzai et al. 2008).

A sixth survey was finally carried out in 2011 by a partnership of American and Iraqi academics (Hagopian et al. 2013). The survey consisting of 100 clusters of 20 households each covered almost the entire duration of the war. Data were collected in all but one cluster, which was skipped for security reasons. Household response rate was 98.6 per cent. Information on household composition, births and deaths since January 2001 was recorded. The relative risk of death associated with the war was assessed by comparing mortality before the US-led invasion (January 2001 to March 2003) and throughout the course of the war (March 2003 to June 2011). The survey analysis, which was published in *PLoS Medicine,* yielded an overall estimate of 405,000 excess deaths attributable to the 2003–2011 Iraq War, with a 95 per cent confidence interval of 48,000 to 751,000 deaths. The researchers added a correction for deaths that occurred in households which had subsequently fled the country. They estimated that the survey missed at least 55,000 deaths that would have been reported had the households remained behind in Iraq.

Despite the wide range of their estimated death tolls, these surveys have provided a relatively clear outline of trends, causes and geographical distribution of war-related mortality in Iraq (Crawford 2013). Notably, they have been consistent on a number of key findings. All these surveys have recorded a dramatic increase in mortality from 2003 onwards, compared to the pre-war period. The increase in mortality has been driven by pervasive violence, with adolescent and adult men being the most severely affected. Virtually all war-related mortality occurred in central and southern Iraq, whereas the autonomous northern Kurdistan region remained relatively safe.

A systematic review of these surveys, which was published in *Conflict and Health*, explained that the variance in estimates is partially attributable to definitional differences. For example, some of these surveys limited their mortality totals to civilians while other included combatants; some surveys reported only violent deaths while other included war-induced excess deaths for all causes. The review also highlighted the need for an appraisal checklist with a number of indicators to assess the extent of potential sources of bias, such as coverage imprecision, non-response and measurement errors, that may affect the representativeness of these and similar surveys in war settings (Tapp et al. 2008).

The key findings of mortality surveys, and the associated considerations on survey data quality, constitute the starting point for this thesis. The next five chapters are structured as follows. Chapter II introduces and evaluates the Iraq Multiple Indicator Cluster Surveys (I-MICS), which are the main data sources used in this thesis. Iraq is one of the few countries where one of these surveys was conducted just a few years before the war, in 2000, and then repeated twice during the war, in 2006 and 2011. These surveys were carried out in the safe autonomous northern Kurdistan region as well as in war-torn central/southern Iraq. To disentangle the potential undermining effect of war on survey representativeness, I compare the prevalence of coverage imprecision, non-response and measurement errors before and during war distinguishing between war-affected and not affected regions. Although the importance of considering survey data quality in war settings has been widely recognised, this is the first comparative assessment of this kind.

Chapter III relies on retrospective birth histories form the 2006 and 2011 I-MICS to provide the first detailed account of fertility trends in Iraq. Birth histories were not collected in the 2000 I-MICS, which is therefore not included as a data source for this chapter. I pool data from the two available surveys to reconstruct total and age-specific fertility trends from 1997 to 2010, allowing for comparisons over a period spanning before and after the onset of the war. Using decomposition techniques, I quantify how much of the change in fertility rates during wartime was accounted for by changes in the proportion of married women and how much by changes in the prevalence of birth control within marriage. The analysis focuses on central/southern Iraq and is conducted separately for the autonomous Kurdistan region. The findings have important documentation functions and critical implications for the design of women's empowerment and reproductive health strategies.

Chapter IV relies on retrospective neonatal polio vaccination histories from the 2000, 2006 and 2011 I-MICS to assess whether and to what extent the war affected neonatal polio immunisation coverage. Pooling these surveys makes it possible to reconstruct yearly trends in immunisation coverage from 1996 to 2010. I identify the impact of the war using a quasi-experimental research design. Specifically, I adopt a difference-in-difference regression model to contrast neonatal polio immunisation trends in the safe Kurdistan region with trends in war-torn central/southern Iraq. The model controls for potential confounding factors, such as individual and household characteristics, year of birth and governorate of residence. The findings contribute to the assessment of the public health legacies of war, with important implications for the design of maternal and newborn health care strategies.

Chapter V provides the first quantitative assessment of Iraq's health sector rehabilitation outcomes. In the aftermath of the US-led invasion, Iraq's Ministry of Health has set plans to expand health service delivery, by reorienting the public health sector towards primary health care and attributing a larger role to the private sector for hospital care. The separate Ministry of Health of the autonomous Kurdistan region has shared a similar approach. I and Dr. Nazar P. Shabila compare the expansion in number, type and location of health facilities per 100,000 population in the Kurdistan region, which has been relatively stable from 2003 onwards, and in central/southern Iraq, where persistent insecurity has posed major challenges to health care system recovery. The assessment highlights the need for new health care strategies, taking into account the ongoing insecurity and persistently high rate of population growth.

Chapter VI concludes by summarising the main contributions of the thesis and discussing directions for future research.

Table 1.1 *Survey-based studies of mortality during the 2003–2011 Iraq War*

Authors	Period	Sample	Methods	Estimates
Roberts et al. (2004)	Jan 2002 – Sep 2004	30 clusters of 30 households each, with a response rate of 99.3%	The relative risk of death associated with the war was estimated by comparing the crude mortality rate in the 17.8 months after the US-led invasion (Mar 2003 to Sep 2004) with the 14.6 months preceding it (Jan 2002 to Mar 2003)	98,000 deaths (95% CI 8,000 –194,000)
UNDP (2005)	Mar 2003 – May 2004	2,200 clusters of 10 households each, with a response rate of 98.5%	The survey recorded the number of dead and missing persons due to violence causes from Mar 2003 to May 2004	23,743 deaths (95% CI 18,187 –29,299)
Burnham et al. (2006)	Jan 2002 – Jul 2006	47 clusters of 40 households each, with a response rate of 98.4%	The death toll attributable to the war was estimated by comparing the crude mortality rate for the period before (Jan 2002 to Mar 2003) and after (Mar 2003 to Jul 2006) the US-led invasion	654,965 deaths (95% CI 392,979 – 942,636)
ORB (2007)	Mar 2003 – Aug 2007	112 clusters of 20 households each, with a response rate of 87.2%	The survey asked how many members of the household, if any, have died as a result of the conflict in Iraq from Mar 2003 to Aug 2007	1,220,580 deaths (95% CI 733,158 – 1,446,063)
Alkhuzai et al. (2008)	Jan 2002 – Jul 2006	1,086 clusters of 10 households each, with a response rate of 98.4%	The survey compared the violence-related mortality rate for the period before (Jan 2002 to Mar 2003) and after (Mar 2003 to Jul 2006) the US-led invasion	151,000 deaths (95% CI 104,000 – 223,000)
Hagopian et al. (2013)	Jan 2001 – Jun 2011	100 clusters of 20 households each, with a response rate of 98.6%	The relative risk of death attributable to the war was estimated by comparing the crude mortality rate before the US-led invasion (Jan 2001 to Mar 2003) and throughout the course of the war (Mar 2003 to Jun 2011)	405,000 deaths (95% CI 48,000 – 751,000)

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CHAPTER II. Is it feasible to collect representative household survey data during war? Evidence from Iraq

2.1 Introduction

In countries with flawed vital registration and health surveillance systems, household surveys are the main source for estimating levels and trends of key demographic and health indicators and to relate them to the broad social, economic and political context. As such, survey data can provide useful guidelines for interventions aimed at protecting and improving population health. Although up-to-date information on demographic and health indicators would be especially important during periods of dramatic societal change induced by war, the design and implementation of household surveys in war-torn countries present many challenges that can potentially undermine their representativeness.

The feasibility of collecting representative survey data during wartime is a subject of considerable debate. Some researchers argue that the requirements for probability sampling and structured interviews are usually impaired in war-torn settings (Barakat et al. 2002; Spagat 2012), whereas others sustain that sound survey research is possible albeit difficult (Thoms and Ron 2007; Haer and Becher 2012). Establishing whether representativeness is compromised during war has also ethical implications. Given the risks for interviewers and respondents, survey research is deemed ethically justified only if it can ensure reliable evidence to inform advocacy for populations caught in war (Goodhand 2000; Black 2003; Zwi et al. 2006; Ford et al. 2009).

However, the debate around the potential undermining effect of war has remained limited to small ad hoc surveys (see Mneimneh et al. 2014 for a review of existing literature). Surprisingly, the debate lacks any assessment of leading survey programmes, such as the UNICEF Multiple Indicator Cluster Surveys (MICS). For nearly two decades, the MICS programme has repeatedly collected demographic and health data from large household samples to monitor the situation of women and children in over 100 countries, with some of them experiencing periods of war (UNICEF 2006; 2014).

I argue that an analysis of MICS can provide a more compelling account of the effect of war on household survey representativeness. In order to speculate how representative a survey would have been in the absence of war, an appropriate counterfactual is needed. This is because potential sources of bias, such as coverage imprecision, non-response and measurement errors, are also common in surveys conducted during peacetime (see Arnold 1990; Marckwardt and Rutstein 1996; Pullum 2006; UNICEF 2009; 2013). Unlike small ad hoc surveys, the MICS programme uses standardised questionnaires allowing for a comparative assessment of data collected in the same country before and during war. Furthermore, their large sample sizes permit to distinguish between war-affect and not affected regions within country.

This paper focuses on the 2003–2011 Iraq War as a case study. Iraq is one of the few countries where one MICS was conducted just a few years before the war, in 2000, and then repeated twice during the war, in 2006 and 2011. These surveys were carried out in the autonomous northern Kurdistan region, which remained relatively safe during the war, as well as in the rest of Iraq (centre/south), where violence and disruption were pervasive (Iraq Council of Ministers, Planning Commission and Central Statistical Organisation 2001; Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007; 2013). This makes it possible to test the feasibility of collecting representative survey data during war using within- and between-survey comparisons. Despite the intense debate around the potential undermining effect of war on survey representativeness, this is the first comparative assessment of this kind.

The paper is organised as follows. Section 2 reviews the main types of errors affecting household survey representativeness and discusses why these errors may be more likely in war settings. Section 3 provides details on the MICS data and explains the analytical approach used to identify the potential undermining effect of war. The outcomes of the survey assessments are reported in section 4. Section 5 concludes discussing the overall findings of this study and their ethical as well as practical implications.

2.2 War and survey representativeness

The primary indication of a survey quality is given by its level of representativeness of the target population. A representative survey is one that has strong external validity in relationship to the population that is meant to represent. As such, its estimates reflect the actual parameter values in the population and can be generalised with confidence (Biemer and Lyberg 2003; Davern 2008; Groves et al. 2009). This reviews focuses on common types of errors that may cause survey estimates to differ from actual values in the population, that are coverage imprecision, non-response and measurement errors.

To be representative, a survey should employ a probability sampling procedure in which the population units are selected randomly with known and nonzero probabilities. A truly random sample can only be obtained by using as a sampling frame a complete list of all units of the target population and by gathering accurate data from each and every sampled unit. These conditions are rarely, if ever, met in survey research. Sampling frames are never perfect, and data for some sampled units are missed or inaccurate in virtually all surveys. Frame coverage imprecision, non-response, and measurement errors may compromise survey representativeness. This is because population units whose information is missing or inaccurate may differ from those who were successfully contacted and accurately interviewed. If these differences involve the parameters being estimated and if the rates of coverage imprecision, non-response and measurement errors are high, the sample is biased and the resulting survey estimates cannot be generalised to the population (Vogt 2005; Davern 2008; Mulry 2008; Dixton and Tucker 2010).

The best sampling frame for household surveys is a list of enumeration areas from a recently completed population census. In the absence of a census frame, a complete list of neighbourhoods and villages with all necessary identification information, including cartographic materials and measures of population size, can be used as an alternative sampling frame. Ideally, all sampled households should be contacted during fieldwork. The eligible household members that the survey aims to interview should then be identified and agree to be take part in the survey. Coverage imprecision arises any time an incomplete or outdated frame is used to select households. Unit non-response occurs when some sampled households or eligible individuals within households are not contacted or refuse to be interviewed, while item non-response arises any time some survey questions are skipped intentionally or unintentionally. Finally, measurement errors occur when the survey measures of the items under study deviate from the true values (Briemer and Lyberg 2003; Kasprzyk 2005; Lepkowski 2005; Bethlehem, Cobben and Schouten 2011).

Although good survey practice during wartime is not different from good general survey practice, the contextual dimensions of war, such as political tension, generalised violence and damaged infrastructure, pose special obstacles to sample selection and fieldwork (Mneimneh et al. 2014). Due to war-induced displacement, household mergers and dissolutions, the target population may change considerably in short periods of time and pre-existing frames quickly became outdated (Haer and Becher 2012; Spagat 2012). Non-response and measurement errors also risk to be exacerbated. On the interviewers' side, mobility challenges stemming from generalised violence and damaged infrastructure may lead to a higher non-contact rate during fieldwork. When households are successfully contacted, time and security constraints may induce interviewers to rush through the interview, skip questions or fabricate answers. On the households' side, mistrust of survey aims and fear of repercussions may increase refusal to participate in the survey altogether or to answer specific questions. The experience of stressful and traumatising events may also hinder respondents' ability of accurately recalling information (Barakat et al. 2002; Axinn et al. 2012).

To tackle these challenges and produce high quality survey research, rigorous design and implementation principles should be followed (Mneimneh et al. 2014). A re-mapping of geographical locations with their respective population size and a detailed household listing should be carried out while drawing the sample. To minimise coverage errors, care should be taken to ensure that the time of the listing operations and that of the interviews are not far apart. To preserve a high rate of completeness and accuracy, great efforts should be devoted to train interviewers for these special circumstances, to secure privacy and political neutrality during interviews and to maintain close field supervision (Axinn et al. 2012; Haer and Becher 2012; Mneimneh et al. 2014). Whether such rigour is feasible in war-torn settings is ultimately a matter of empirical determination.

2.3 Methodology

This study provides evidence from three Multiple Indicator Cluster Surveys (MICS) in Iraq to establish empirically whether coverage imprecision, non-response and measurement errors were exacerbated during wartime, and if so, whether the severity of these errors was such to compromise the representativeness of the resulting survey estimates.

The MICS programme was launched by UNICEF in the late 1990s to collect information on demographic and health indicators required for monitoring the situation of women and children (UNICEF 2006; 2014). The programme has covered a wide range of countries on a regular basis. A few of these surveys were undertaken during wartime. In particular two MICS were carried out during the 2003–2011 Iraq War. Data were collected in 2006 and 2011 in the safe autonomous northern Kurdistan region as well as in war-torn central/southern Iraq. Importantly for the purpose of this study, a previous MICS was conducted both in Kurdistan and central/southern Iraq in 2000. This makes it possible to compare survey representativeness before and during war distinguishing between war-affected and not affected regions.

As most household surveys, the MICS programme uses a multistage probability sampling procedure. First, a number of geographical locations are selected with probability proportional to their population size. A list of residential dwellings is prepared for each of the sampled locations and a cluster of households is drawn within each location by equal probability systematic sampling (Yansaneh 2005). A straightforward indicator of list frame imprecision is given by the rate of selected households that could not be identified during fieldwork because the address provided in the list frame was not a dwelling or because the dwelling was vacant or destroyed (UNICEF 2013).

The MICS questionnaires include three standard core modules. A household module is administered to the household head or any other responsible adult, with the main purpose of gathering information regarding the age and sex of all household members. Information is collected by asking the following questions: (i) “Please tell me the name of each person who usually lives here”; (ii) “Is (name) male or female?”; (iii) “How old is (name)?” (see annex). A common approach to detect measurement errors affecting eligibility for interview is to examine the household composition and identify deviations from expected sex and age patterns (UNICEF 2013).

All women who are reported in the household module between ages 15 and 49 are eligible for the individual interview. The latter includes questions on women's characteristics with a special focus on their reproductive health (see chapter III). Women with children aged less than five at the date of the survey are also asked to complete a child health module (see chapter IV). The extent of non-response is given by the rate of household, individual and child health modules that could not be completed because the eligible respondents were not contacted or refused to take part in the survey (UNICEF 2013).

In what follows, I examine sampling selection procedures and calculate the rate of precision for household list frames. I then compute the rate of response for those households that were successfully identified and for eligible women and children within households. I also examine household composition to identify any significant changes in the rate of eligible women and children out of all household members, which are more plausibly explained by representativeness flaws than by real phenomena. The potential undermining effect of war is disentangled by comparing the prevalence of coverage imprecision, non-response and measurement errors in each of the three MICS separately for Kurdistan and central/southern Iraq.

2.4 Results

Within the MICS initiative, UNICEF provided financial and technical support to the Iraqi Central Organisation for Statistics and Information Technology and the Kurdistan Regional Statistics Office, in coordination with the Ministry of Health, to conduct three surveys in

2000, 2006 and 2011. The surveys were designed to be representative of the whole country (Iraq Council of Ministers, Planning Commission and Central Statistical Organisation 2001; Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007; 2013).

The first MICS was carried out less than 3 years before the US-led military invasion, which marked the onset of the 2003–2011 war. The sampling frame for central/southern Iraq was derived from the 1997 census and population estimates for the survey period were projected by the Iraqi Central Organisation for Statistics and Information Technology. The 1997 census did not cover the three northern Kurdish governorates of Erbil, Duhok and Sulaimaniya, which following the 1991 Kurdish uprising had become a de facto autonomous region under UN auspices. The sampling frame for this region was based on population estimates provided by the statistical offices of the three Kurdish governorates.

The total sample for the survey was set at 13,430 households. Each governorate was allocated an equal sample size of 740 households, except the governorate of Baghdad where the sample was set at 850 households. Within governorates, the sample was distributed among rural and urban areas of each district in proportion to the size of population. The sampling procedures followed three stages. Firstly, all neighbourhoods in urban areas and villages in rural areas were listed with estimates of their respective population size. A number of neighbourhoods and villages were selected according to linear systematic probability proportionate to size. The selected neighbourhoods and villages were then divided into segments of approximately 500 buildings and a number of segments were selected as a second stage of sampling with probability proportionate to size. Segments were divided into blocks of 25–30 buildings in urban areas and 20–25 buildings in rural areas, and one block was drawn from each segment using simple random sampling. Finally, a household list was prepared and a cluster of 10 households was selected from each block by systematic random sampling. List frame precision was very high: 97.5 per cent of the 11,123 sampled households in central/southern Iraq and 98.5 per cent of the 2,217 sampled households in Kurdistan were successfully identified during fieldwork.

The second MICS was undertaken during the most violent phase of the war. The sampling frame was again derived from the 1997 census as no other census had been hold since then. Due to population growth and war-induced migration, the census no longer represented the population distribution of central/southern Iraq accurately in 2006. Neighbourhoods and villages were re-mapped to ensure that population was not missed during the sampling selection process. As for the 2000 MICS, the sampling frame for Kurdistan relied on population measures provided by the statistical office of the three Kurdish governorates.

The total sample was set at 18,136 households. Three sampling domains were selected for each governorate except for Baghdad where five domains were selected, representing rural, urban and metropolitan areas. A two-stage sampling procedure was adopted. Within each of the 56 sampling domains, 54 blocks of 70–100 buildings were drawn with linear systematic probability proportional to size. A linear systematic sample of six households was selected within each block. A cluster size of six households was chosen to allow the survey team to complete a full cluster in minimal time given the security concerns. One cluster in the governorate of Anbar could not be accessed and was not replaced. In the remaining 3,023 clusters, list frame precision was very high. Of the 15,220 sampled households in central/southern Iraq and 2,916 sampled households in Kurdistan, 99.8 and 99.5 per cent were successfully identified during fieldwork.

The third survey was conducted a few months before the US-led coalition forces left the country, marking the official end of the war. In 2010 a new sampling frame was designed in preparation for a general population census covering both Kurdistan and central/southern Iraq. However, due to political tensions and persistent insecurity, the census has been postponed several times and has not been held yet. The 2011 MICS relied on this new frame for sampling selection.

The total sample was set at 36,592 households. Urban and rural areas within each district were identified as the main sampling domains. Sample sizes differ between governorates depending on the number of districts in each governorate. The sample was selected in two stages. Within each of the 85 districts in central/southern Iraq and 33 districts in Kurdistan, 31 blocks of 70–100 buildings each were selected with probability proportional to population size. After a household listing was prepared, a systematic sample of 10 households was drawn in each of the selected blocks. No deviation from the original sample design was made. Of the 26,361 sampled households in centre/south and 10,231 sampled households in Kurdistan, 98.9 and 95.4 per cent were successfully identified during fieldwork.

Such high rates of list frame precision are in line with similar surveys in other Middle Eastern countries. For example, the rate of list frame precision was 92.9 per cent in the 2000 Lebanon MICS, 98.5 per cent in the 2003 Libya MICS, 99.2 per cent in the 2006 Syria MICS, 96.5 per cent in the 2010 Palestine MICS, and 99.1 per cent in the 2012 Qatar MICS (Lebanon Presidency of the Council of Ministers and Central Bureau of Statistics 2001; Libya People’s Committee and Public Commission for Health Care Planning 2003; Syria Central Bureau of Statistics, Ministry of Health and State Planning Commission 2008; Palestinian Central Bureau of Statistics 2013; Qatar Ministry of Development Planning and Statistics 2014).

Tables 2.1 and 2.2 show the rates of response for those households that were successfully identified during fieldwork. The rates were very high and stable across the three surveys. In 2000, 99.7 per cent of identified households in central/southern Iraq were contacted and agreed to be interviewed. The corresponding rate was 99.3 per cent in 2006 and 99.7 per cent in 2011. The rate of response was virtually identical for urban and rural households, and differentials across governorates were minimal. The fact that participation to the survey was almost universal indicates that household non-contact and refusal are not necessarily exacerbated during wartime. Household response was also very high across the three surveys in Kurdistan. The rate was 97.0 per cent in 2000, 96.1 per cent in 2006 and 99.5 per cent in 2011, with little variation across governorates and areas of residence.

For comparison, the rate of household response was 94.5 per cent in the 2000 Lebanon MICS, 95.1 per cent in the 2003 Libya MICS, 95.7 per cent in the 2006 Syria MICS, 92.0 per cent in the 2010 Palestine MICS, and 99.1 per cent in the 2012 Qatar MICS (Lebanon Presidency of the Council of Ministers and Central Bureau of Statistics 2001; Libya People's Committee and Public Commission for Health Care Planning 2003; Syria Central Bureau of Statistics, Ministry of Health and State Planning Commission 2008; Palestinian Central Bureau of Statistics 2013; Qatar Ministry of Development Planning and Statistics 2014).

Tables 2.3 and 2.4 provide evidence on the sex and age structure of interviewed households. In central/southern Iraq, the total number of reported household members was 84,232 in the 2000 MICS, 99,369 in the 2006 MICS and 183,174 in the 2011 MICS. The sex ratio was around 100 males to 100 females, and information about age was complete for virtually all household members. Although there is clearly some heaping at ages with terminal digits '0' and '5', the extent of measurement errors in age reporting appears relatively similar before and during war. Women between ages 15 and 49 constituted 23.6 per cent of all household members in 2000, 23.5 per cent in 2006 and 23.1 per cent in 2011. Children aged less than five were 15.2 per cent of all household members in 2000, 14.4 per cent in 2006 and 16.2 per cent in 2011. The fact that the percentages of women and children out of all household members remained constant across surveys reassures that eligible respondents for the individual and child health modules were not inadvertently and intentionally excluded during war. In Kurdistan, the number of household members was 13,477, 16,746, and 55,150 respectively. Eligible women were 24.0 per cent of all household members in 2000, 25.0 per cent in 2006 and 25.6 per cent in 2011. The rate of eligible children was 14.5, 13.6, and 12.5 per cent.

Finally, tables 2.5 to 2.6 show the rates of response to the individual and child health modules. In 2000, 99.7 per cent of eligible women were successfully contacted and agreed to complete the individual module. In 2006 and 2011, the corresponding rates were 99.1 and 98.6 per cent. Response to the child health module was virtually universal: 99.5 per cent in 2000, 99.5 per cent in 2006 and 99.3 per cent in 2011. Overall, there is no evidence that survey representativeness was undermined in central/southern Iraq during war. The rates of response to the individual and child health modules in Kurdistan were similarly high: 99.4 and 99.7 per cent in 2000, 95.7 and 98.8 per cent in 2006 and 95.2 and 98.7 per cent in 2011.

Table 2.1 *Identified and interviewed households by governorate and area of residence, central/southern Iraq*

	2000 MICS			2006 MICS			2011 MICS		
	Identified	Interviewed		Identified	Interviewed		Identified	Interviewed	
Locations	no.	no.	%	no.	no.	%	no.	no.	%
Baghdad	832	827	99.4	1,614	1,594	98.8	3,042	3,019	99.2
Basrah	729	721	98.9	967	943	97.5	2,167	2,155	99.4
Nineveh	729	729	100.0	972	967	99.5	2,140	2,139	100.0
Maysan	676	675	99.9	972	971	99.9	1,846	1,843	99.8
Dewaniya	723	723	100.0	972	971	99.9	1,230	1,224	99.5
Diala	670	670	100.0	972	972	100.0	1,829	1,825	99.8
Anbar	740	740	100.0	957	941	98.3	2,437	2,430	99.7
Babylon	740	740	100.0	971	969	99.8	1,231	1,228	99.8
Kerbala	739	739	100.0	971	956	98.5	924	924	100.0
Kirkuk	735	731	99.5	968	954	98.6	1,229	1,227	99.8
Wasit	718	713	99.3	972	972	100.0	1,832	1,822	99.5
Thi-Qar	740	737	99.6	970	966	99.6	1,546	1,545	99.9
Muthanna	728	720	98.9	972	971	99.9	1,235	1,234	99.9
Salahaldin	698	694	99.4	971	970	99.9	2,457	2,450	99.7
Najaf	733	733	100.0	971	968	99.7	922	919	99.7
Urban	6,573	6,549	99.6	10,348	10,261	99.2	15,040	14,975	99.6
Rural	4,357	4,343	99.7	4,844	4,824	99.6	11,027	11,009	99.8
Total	10,930	10,892	99.7	15,192	15,085	99.3	26,067	25,984	99.7

Source: Author's calculations using 2000, 2006 and 2011 Iraq MICS

Table 2.2 *Identified and interviewed households by governorate and area of residence, Kurdistan*

	2000 MICS			2006 MICS			2011 MICS		
	Identified	Interviewed		Identified	Interviewed		Identified	Interviewed	
Locations	no.	no.	%	no.	no.	%	no.	no.	%
Erbil	729	697	95.6	964	912	94.6	2,927	2,910	99.4
Duhok	734	732	99.7	969	956	98.7	2,102	2,090	99.4
Sulaimaniya	721	690	95.7	968	920	95.0	4,732	4,717	99.7
Urban	1,451	1,415	97.5	1,933	1,852	95.8	6,469	6,431	99.4
Rural	733	704	96.0	968	936	96.7	3,292	3,286	99.8
Total	2,184	2,119	97.0	2,901	2,788	96.1	9,761	9,717	99.5

Source: Author's calculations using 2000, 2006 and 2011 Iraq MICS

Table 2.3 *Reported sex and age structure of household members, central/southern Iraq*

	2000 MICS				2006 MICS				2011 MICS			
	Males		Females		Males		Females		Males		Females	
Age	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
0	1,286	3.1	1,282	3.0	1,543	3.1	1,554	3.2	3,055	3.3	2,975	3.3
1	1,191	2.8	1,225	2.9	1,577	3.1	1,506	3.1	3,074	3.3	2,841	3.1
2	1,125	2.7	1,171	2.8	1,444	2.9	1,380	2.8	3,018	3.3	2,763	3.0
3	1,376	3.3	1,348	3.2	1,456	2.9	1,344	2.7	2,856	3.1	2,706	3.0
4	1,172	2.8	1,017	2.4	1,292	2.6	1,332	2.7	2,575	2.8	2,542	2.8
5	1,232	2.9	1,207	2.9	1,591	3.2	1,509	3.1	2,798	3.0	2,660	2.9
6	1,279	3.0	1,264	3.0	1,427	2.8	1,347	2.7	2,769	3.0	2,697	3.0
7	1,317	3.1	1,187	2.8	1,381	2.8	1,284	2.6	2,561	2.8	2,365	2.6
8	1,351	3.2	1,116	2.7	1,322	2.6	1,292	2.6	2,425	2.6	2,344	2.6
9	1,218	2.9	1,259	3.0	1,355	2.7	1,250	2.5	2,518	2.7	2,347	2.6
10	1,444	3.4	1,218	2.9	1,293	2.6	1,292	2.6	2,399	2.6	2,319	2.6
11	1,125	2.7	1,119	2.7	1,361	2.7	1,281	2.6	2,440	2.6	2,215	2.4
12	1,001	2.4	1,153	2.7	1,353	2.7	1,218	2.5	2,075	2.3	2,129	2.3
13	1,044	2.5	969	2.3	1,191	2.4	1,286	2.6	2,231	2.4	2,102	2.3
14	1,065	2.5	1,046	2.5	1,178	2.4	1,186	2.4	2,157	2.3	2,209	2.4
15	1,062	2.5	991	2.4	1,342	2.7	1,236	2.5	2,145	2.3	1,850	2.0
16	1,066	2.5	969	2.3	1,213	2.4	1,204	2.5	2,058	2.2	2,070	2.3
17	963	2.3	943	2.2	1,106	2.2	1,055	2.1	1,991	2.2	2,033	2.2
18	1,043	2.5	985	2.3	1,049	2.1	1,058	2.2	2,029	2.2	1,926	2.1
19	926	2.2	851	2.0	969	1.9	970	2.0	1,896	2.1	1,645	1.8
20	952	2.3	973	2.3	1,081	2.2	976	2.0	2,111	2.3	1,747	1.9
21	838	2.0	922	2.2	1,012	2.0	940	1.9	1,876	2.0	1,799	2.0
22	838	2.0	769	1.8	947	1.9	854	1.7	1,654	1.8	1,539	1.7
23	850	2.0	776	1.8	920	1.8	918	1.9	1,578	1.7	1,395	1.5
24	797	1.9	772	1.8	847	1.7	825	1.7	1,499	1.6	1,371	1.5
25	759	1.8	708	1.7	959	1.9	831	1.7	1,475	1.6	1,470	1.6
26	652	1.6	655	1.6	836	1.7	766	1.6	1,338	1.5	1,274	1.4
27	644	1.5	612	1.5	834	1.7	732	1.5	1,302	1.4	1,272	1.4
28	599	1.4	685	1.6	735	1.5	773	1.6	1,386	1.5	1,302	1.4
29	613	1.5	586	1.4	660	1.3	691	1.4	1,262	1.4	1,182	1.3
30	563	1.3	621	1.5	737	1.5	655	1.3	1,340	1.5	1,181	1.3
31	560	1.3	582	1.4	618	1.2	673	1.4	1,288	1.4	1,240	1.4
32	547	1.3	535	1.3	686	1.4	720	1.5	1,141	1.2	1,295	1.4
33	442	1.1	465	1.1	651	1.3	654	1.3	1,138	1.2	1,159	1.3
34	431	1.0	478	1.1	614	1.2	688	1.4	1,077	1.2	1,090	1.2
35	445	1.1	547	1.3	724	1.4	597	1.2	1,018	1.1	1,159	1.3
36	464	1.1	435	1.0	661	1.3	608	1.2	980	1.1	1,116	1.2
37	394	0.9	451	1.1	526	1.1	563	1.1	1,094	1.2	1,062	1.2
38	335	0.8	470	1.1	501	1.0	535	1.1	1,082	1.2	1,147	1.3
39	256	0.6	385	0.9	477	1.0	458	0.9	979	1.1	1,097	1.2
40	328	0.8	363	0.9	586	1.2	531	1.1	995	1.1	992	1.1
41	201	0.5	254	0.6	455	0.9	473	1.0	969	1.1	1,029	1.1
42	222	0.5	239	0.6	443	0.9	428	0.9	871	0.9	885	1.0
43	358	0.9	321	0.8	357	0.7	413	0.8	826	0.9	892	1.0
44	310	0.7	349	0.8	302	0.6	350	0.7	823	0.9	817	0.9
45	346	0.8	432	1.0	375	0.8	404	0.8	723	0.8	737	0.8
46	288	0.7	377	0.9	252	0.5	263	0.5	734	0.8	809	0.9
47	261	0.6	336	0.8	211	0.4	234	0.5	690	0.8	676	0.7
48	322	0.8	311	0.7	311	0.6	281	0.6	677	0.7	655	0.7
49	259	0.6	219	0.5	277	0.6	158	0.3	518	0.6	446	0.5
50	363	0.9	455	1.1	393	0.8	666	1.4	506	0.6	797	0.9
51	232	0.6	259	0.6	314	0.6	478	1.0	378	0.4	637	0.7

52	130	0.3	203	0.5	326	0.7	421	0.9	344	0.4	447	0.5
53	241	0.6	283	0.7	290	0.6	357	0.7	535	0.6	655	0.7
54	207	0.5	133	0.3	248	0.5	252	0.5	570	0.6	482	0.5
55	235	0.6	282	0.7	375	0.8	350	0.7	504	0.6	646	0.7
56	149	0.4	92	0.2	223	0.4	244	0.5	477	0.5	651	0.7
57	199	0.5	159	0.4	171	0.3	143	0.3	517	0.6	508	0.6
58	169	0.4	170	0.4	249	0.5	227	0.5	459	0.5	512	0.6
59	146	0.4	99	0.2	168	0.3	117	0.2	369	0.4	407	0.5
60	204	0.5	183	0.4	280	0.6	316	0.6	465	0.5	526	0.6
61	138	0.3	105	0.3	141	0.3	99	0.2	268	0.3	359	0.4
62	98	0.2	79	0.2	175	0.4	119	0.2	253	0.3	219	0.2
63	131	0.3	220	0.5	160	0.3	133	0.3	329	0.4	371	0.4
64	62	0.2	40	0.1	143	0.3	114	0.2	208	0.2	181	0.2
65	110	0.3	128	0.3	176	0.4	205	0.4	298	0.3	325	0.4
66	77	0.2	45	0.1	115	0.2	105	0.2	224	0.2	183	0.2
67	67	0.2	60	0.1	75	0.2	69	0.1	279	0.3	180	0.2
68	120	0.3	196	0.5	126	0.3	125	0.3	244	0.3	218	0.2
69	69	0.2	34	0.1	55	0.1	45	0.1	132	0.1	111	0.1
70	144	0.3	149	0.4	101	0.2	136	0.3	167	0.2	253	0.3
71	59	0.1	42	0.1	56	0.1	48	0.1	168	0.2	135	0.2
72	41	0.1	47	0.1	75	0.2	66	0.1	101	0.1	95	0.1
73	127	0.3	177	0.4	90	0.2	103	0.2	120	0.1	199	0.2
74	31	0.1	14	0.0	45	0.1	39	0.1	65	0.1	45	0.1
75	58	0.1	72	0.2	80	0.2	84	0.2	78	0.1	123	0.1
76	15	0.0	21	0.1	51	0.1	37	0.1	99	0.1	65	0.1
77	22	0.1	14	0.0	39	0.1	30	0.1	78	0.1	58	0.1
78	73	0.2	78	0.2	48	0.1	93	0.2	94	0.1	186	0.2
79	8	0.0	9	0.0	27	0.1	25	0.1	58	0.1	28	0.0
80	34	0.1	91	0.2	44	0.1	61	0.1	111	0.1	122	0.1
81	24	0.1	7	0.0	15	0.0	12	0.0	50	0.1	44	0.1
82	19	0.0	25	0.1	11	0.0	11	0.0	34	0.0	21	0.0
83	51	0.1	45	0.1	35	0.1	46	0.1	77	0.1	133	0.2
84	12	0.0	10	0.0	17	0.0	13	0.0	15	0.0	29	0.0
85	14	0.0	14	0.0	33	0.1	20	0.0	38	0.0	47	0.1
86	8	0.0	9	0.0	3	0.0	11	0.0	9	0.0	15	0.0
87	11	0.0	7	0.0	11	0.0	4	0.0	11	0.0	13	0.0
88	23	0.1	21	0.1	28	0.1	25	0.1	53	0.1	37	0.0
89	2	0.0	5	0.0	6	0.0	16	0.0	9	0.0	9	0.0
90	9	0.0	28	0.1	9	0.0	14	0.0	11	0.0	45	0.1
91	3	0.0	3	0.0	3	0.0	7	0.0	10	0.0	12	0.0
92	1	0.0	2	0.0	5	0.0	2	0.0	8	0.0	8	0.0
93	13	0.0	10	0.0	6	0.0	8	0.0	25	0.0	37	0.0
94	0	0.0	2	0.0	5	0.0	1	0.0	1	0.0	12	0.0
95+	8	0.0	11	0.0	10	0.0	10	0.0	20	0.0	28	0.0
Missing	18	0.0	11	0.0	82	0.2	110	0.2	3	0.0	1	0.0
Total	42,135	100.0	42,097	100.0	50,176	100.0	49,193	100.0	92,386	100.0	90,788	100.0

Source: Author’s calculations using 2000, 2006 and 2011 Iraq MICS

Table 2.4 *Reported sex and age structure of household members, Kurdistan*

	2000 MICS				2006 MICS				2011 MICS			
	Males		Females		Males		Females		Males		Females	
Age	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
0	189	2.8	237	3.5	198	2.4	239	2.8	644	2.3	682	2.5
1	221	3.3	220	3.3	236	2.9	229	2.7	603	2.2	682	2.5
2	178	2.6	149	2.2	215	2.6	205	2.4	749	2.7	678	2.5
3	184	2.7	184	2.7	213	2.6	195	2.3	669	2.4	665	2.4
4	174	2.6	166	2.5	202	2.4	182	2.2	710	2.6	637	2.3
5	180	2.7	163	2.4	249	3.0	273	3.2	764	2.8	717	2.6
6	182	2.7	156	2.3	242	2.9	252	3.0	743	2.7	715	2.6
7	181	2.7	188	2.8	229	2.8	223	2.6	713	2.6	633	2.3
8	147	2.2	162	2.4	223	2.7	197	2.3	682	2.5	632	2.3
9	193	2.9	192	2.9	224	2.7	193	2.3	727	2.6	711	2.6
10	221	3.3	198	3.0	208	2.5	192	2.3	731	2.7	768	2.8
11	187	2.8	205	3.1	174	2.1	201	2.4	724	2.6	671	2.4
12	188	2.8	161	2.4	191	2.3	185	2.2	756	2.7	600	2.2
13	202	3.0	208	3.1	186	2.2	206	2.4	696	2.5	617	2.2
14	183	2.7	180	2.7	198	2.4	207	2.5	643	2.3	585	2.1
15	180	2.7	182	2.7	220	2.7	235	2.8	629	2.3	608	2.2
16	180	2.7	193	2.9	246	3.0	237	2.8	636	2.3	556	2.0
17	180	2.7	166	2.5	222	2.7	198	2.4	585	2.1	548	2.0
18	167	2.5	152	2.3	228	2.8	184	2.2	591	2.1	566	2.1
19	183	2.7	154	2.3	202	2.4	194	2.3	540	2.0	622	2.3
20	151	2.2	152	2.3	213	2.6	200	2.4	612	2.2	638	2.3
21	141	2.1	135	2.0	201	2.4	189	2.2	673	2.4	606	2.2
22	155	2.3	143	2.1	196	2.4	179	2.1	569	2.1	544	2.0
23	132	2.0	121	1.8	214	2.6	172	2.0	550	2.0	553	2.0
24	137	2.0	120	1.8	141	1.7	164	1.9	575	2.1	498	1.8
25	121	1.8	107	1.6	154	1.9	166	2.0	572	2.1	557	2.0
26	116	1.7	125	1.9	149	1.8	142	1.7	513	1.9	535	1.9
27	118	1.8	126	1.9	129	1.6	143	1.7	598	2.2	525	1.9
28	112	1.7	98	1.5	113	1.4	127	1.5	471	1.7	487	1.8
29	82	1.2	96	1.4	140	1.7	118	1.4	430	1.6	391	1.4
30	117	1.7	107	1.6	122	1.5	118	1.4	420	1.5	460	1.7
31	112	1.7	105	1.6	99	1.2	121	1.4	325	1.2	420	1.5
32	83	1.2	96	1.4	113	1.4	102	1.2	377	1.4	343	1.2
33	82	1.2	56	0.8	109	1.3	127	1.5	342	1.2	386	1.4
34	65	1.0	71	1.1	105	1.3	119	1.4	428	1.6	463	1.7
35	61	0.9	50	0.8	101	1.2	102	1.2	372	1.4	340	1.2
36	37	0.5	62	0.9	94	1.1	94	1.1	332	1.2	355	1.3
37	54	0.8	58	0.9	99	1.2	106	1.3	311	1.1	358	1.3
38	49	0.7	59	0.9	87	1.1	97	1.2	330	1.2	335	1.2
39	27	0.4	51	0.8	53	0.6	75	0.9	354	1.3	346	1.3
40	16	0.2	50	0.7	61	0.7	71	0.8	366	1.3	344	1.3
41	22	0.3	36	0.5	54	0.7	84	1.0	252	0.9	316	1.2
42	12	0.2	26	0.4	52	0.6	65	0.8	304	1.1	233	0.9
43	52	0.8	47	0.7	54	0.7	56	0.7	243	0.9	201	0.7
44	58	0.9	63	0.9	33	0.4	53	0.6	242	0.9	232	0.8
45	47	0.7	59	0.9	48	0.6	52	0.6	209	0.8	224	0.8
46	72	1.1	56	0.8	24	0.3	50	0.6	174	0.6	225	0.8
47	42	0.6	60	0.9	28	0.3	35	0.4	174	0.6	208	0.8
48	44	0.7	51	0.8	68	0.8	64	0.8	134	0.5	187	0.7
49	47	0.7	38	0.6	69	0.8	54	0.6	121	0.4	126	0.5
50	45	0.7	60	0.9	52	0.6	99	1.2	105	0.4	222	0.8
51	29	0.4	36	0.5	53	0.6	76	0.9	66	0.2	133	0.5

52	24	0.4	19	0.3	55	0.7	59	0.7	48	0.2	106	0.4
53	25	0.4	37	0.6	57	0.7	53	0.6	206	0.8	233	0.9
54	28	0.4	21	0.3	48	0.6	45	0.5	181	0.7	170	0.6
55	32	0.5	42	0.6	68	0.8	50	0.6	168	0.6	238	0.9
56	9	0.1	15	0.2	47	0.6	36	0.4	184	0.7	185	0.7
57	38	0.6	26	0.4	25	0.3	15	0.2	134	0.5	208	0.8
58	35	0.5	23	0.3	28	0.3	30	0.4	117	0.4	148	0.5
59	28	0.4	24	0.4	24	0.3	23	0.3	116	0.4	132	0.5
60	23	0.3	29	0.4	26	0.3	44	0.5	166	0.6	134	0.5
61	26	0.4	28	0.4	18	0.2	16	0.2	130	0.5	110	0.4
62	18	0.3	13	0.2	31	0.4	24	0.3	71	0.3	63	0.2
63	28	0.4	34	0.5	14	0.2	44	0.5	62	0.2	80	0.3
64	20	0.3	6	0.1	38	0.5	25	0.3	53	0.2	67	0.2
65	15	0.2	25	0.4	11	0.1	33	0.4	82	0.3	83	0.3
66	28	0.4	16	0.2	26	0.3	17	0.2	53	0.2	46	0.2
67	17	0.3	16	0.2	10	0.1	15	0.2	53	0.2	85	0.3
68	43	0.6	42	0.6	26	0.3	24	0.3	72	0.3	58	0.2
69	21	0.3	9	0.1	15	0.2	11	0.1	47	0.2	48	0.2
70	39	0.6	31	0.5	12	0.2	25	0.3	63	0.2	78	0.3
71	14	0.2	5	0.1	15	0.2	11	0.1	45	0.2	31	0.1
72	7	0.1	6	0.1	17	0.2	7	0.1	28	0.1	30	0.1
73	14	0.2	28	0.4	15	0.2	26	0.3	49	0.2	131	0.5
74	9	0.1	2	0.0	10	0.1	10	0.1	19	0.1	16	0.1
75	4	0.1	18	0.3	28	0.3	26	0.3	33	0.1	38	0.1
76	10	0.2	1	0.0	13	0.2	13	0.2	34	0.1	27	0.1
77	1	0.0	3	0.1	4	0.1	7	0.1	25	0.1	22	0.1
78	8	0.1	10	0.1	16	0.2	21	0.3	66	0.2	99	0.4
79	2	0.0	0	0.0	6	0.1	17	0.2	14	0.1	14	0.1
80	11	0.2	14	0.2	5	0.1	15	0.2	32	0.1	47	0.2
81	5	0.1	7	0.1	2	0.0	0	0.0	25	0.1	13	0.1
82	1	0.0	0	0.0	5	0.1	4	0.1	8	0.0	19	0.1
83	10	0.1	9	0.1	8	0.1	4	0.1	17	0.1	43	0.2
84	1	0.0	0	0.0	4	0.1	4	0.1	7	0.0	4	0.0
85	4	0.1	1	0.0	7	0.1	5	0.1	15	0.1	12	0.0
86	1	0.0	0	0.0	1	0.0	7	0.1	11	0.0	6	0.0
87	2	0.0	1	0.0	3	0.0	2	0.0	9	0.0	3	0.0
88	2	0.0	2	0.0	4	0.1	8	0.1	8	0.0	18	0.1
89	0	0.0	0	0.0	2	0.0	1	0.0	2	0.0	4	0.0
90	1	0.0	3	0.0	1	0.0	1	0.0	6	0.0	12	0.0
91	0	0.0	2	0.0	0	0.0	0	0.0	0	0.0	2	0.0
92	1	0.0	1	0.0	0	0.0	1	0.0	1	0.0	2	0.0
93	1	0.0	4	0.1	3	0.0	0	0.0	12	0.0	13	0.1
94	0	0.0	1	0.0	2	0.0	1	0.0	3	0.0	4	0.0
95+	7	0.1	3	0.0	3	0.0	5	0.1	4	0.0	3	0.0
Missing	7	0.1	6	0.1	8	0.1	19	0.2	14	0.0	9	0.0
Total	6,758	100.0	6,719	100.0	8,295	100.0	8,451	100.0	27,572	100.0	27,578	100.0

Source: Author's calculations using 2000, 2006 and 2011 Iraq MICS

Table 2.5 *Eligible women and children and completed individual and child health interviews, central/southern Iraq*

	2000 MICS			2006 MICS			2011 MICS		
	Eligible	**Interviewed**		**Eligible**	**Interviewed**		**Eligible**	**Interviewed**	
Individuals	**no.**	**no.**	**%**	**no.**	**no.**	**%**	**no.**	**no.**	**%**
Women	19,838	19,774	99.7	23,378	23,179	99.1	42,349	41,772	98.6
Children	12,787	12,724	99.5	14,298	14,225	99.5	29,679	29,478	99.3

Source: Author's calculations using 2000, 2006 and 2011 Iraq MICS

Table 2.6 *Eligible women and children and completed individual and child health interviews, Kurdistan*

	2000 MICS			2006 MICS			2011 MICS		
	Eligible	**Interviewed**		**Eligible**	**Interviewed**		**Eligible**	**Interviewed**	
Individuals	**no.**	**no.**	**%**	**no.**	**no.**	**%**	**no.**	**no.**	**%**
Women	3,241	3,220	99.4	4,186	4,007	95.7	14,106	13,422	95.2
Children	1,957	1,952	99.7	2,272	2,244	98.8	6,920	6,829	98.7

Source: Author's calculations using 2000, 2006 and 2011 Iraq MICS

2.5 Discussion

Monitoring demographic and health indicators during wartime is essential to inform the international community and target humanitarian relief interventions. However, the contextual dimensions of war that make up-to-date demographic and health data so essential also make the design and implementation of representative household surveys more challenging (Mneimneh et al. 2014).

This paper has contributed to the debate around the potential undermining effects of war on survey representativeness, using the 2003–2011 war in Iraq as a case study. Within the UNICEF MICS initiative, two large-scale household surveys were conducted during the war, in 2006 and 2011. These surveys aimed to provide up-to-date information on the situation of Iraqi women and children and allow for a comparison with pre-war indicators that had been collected by a similar survey in 2000. The surveys covered the whole country, including the autonomous northern Kurdistan region, which remained relatively safe during the war, and central/southern Iraq, where violence and disruption were pervasive (Iraq Council of Ministers, Planning Commission and Central Statistical Organisation 2001; Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007; 2013).

The assessment has focused on potential sources of bias that are commonly found in household surveys and may compromise representativeness that are coverage imprecision, non-response and measurement errors. There is no evidence that the prevalence of these errors was exacerbated during wartime. Although the most recent census in Iraq dates back to 1997, extensive remapping of neighbourhoods in urban areas and villages in rural areas was prepared before the first stage of sample selection to ensure population coverage. Detailed household list operations were carried out in the selected locations before the final stage of sample selection. As a result, list frame precision was very high across the three surveys in central/southern Iraq as well as in Kurdistan.

Among those households that were successfully identified, participation to the survey was almost universal, suggesting that the rates of non-contact and refusal are not necessarily higher in war settings. The fact that the percentages of women and children out of all household members remained constant across surveys both in Kurdistan and central/southern Iraq further reassures that eligible respondents for the individual and child health modules were not inadvertently and intentionally excluded. Given the very high levels of participation, it is unlikely that bias due to non-response could have any significant effect on the representativeness of demographic and health estimates produced from these surveys. In chapters III and IV, I show that retrospective birth history and immunisation history data are consistent across surveys, confirming the reliability of MICS estimates.

To conclude, it is noteworthy to consider the ethical implications of this assessment. It has been argued that, given the risks of interviewers and respondents, survey research is ethically justified only if it can bring to light the plight of civil populations caught in war (see Goodhand 2000; Black 2003; Zwi et al. 2006; Ford et al. 2009). The 2006 and 2011 Iraq MICS have shown that sound survey research in war zones is feasible, if rigorous sampling and fieldwork procedures are followed. It is therefore imperative to analyse and disseminate the survey findings to the benefit of all those engaged in improving the status of Iraqi women and children.

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2.7 Annex

MICS HOUSEHOLD INFORMATION PANEL	
HH1. Cluster number: ___ ___ ___	HH2. Household number: ___ ___
HH3. Interviewer name and number: Name ________________________ ___ ___	HH4. Supervisor name and number: Name________________________ ___ ___
HH5. Day / Month / Year of interview: ___ ___ / ___ ___ / ___ ___ ___ ___	
HH6. Area: Urban....1 Rural....2	HH7. Region: *Region 1*....1 *Region 3*....3 *Region 2*....2 *Region 4*....4

WE ARE FROM (***country-specific affiliation***). WE ARE WORKING ON A PROJECT CONCERNED WITH FAMILY HEALTH AND EDUCATION. I WOULD LIKE TO TALK TO YOU ABOUT THESE SUBJECTS. THE INTERVIEW WILL TAKE ABOUT (***number***) MINUTES. ALL THE INFORMATION WE OBTAIN WILL REMAIN STRICTLY CONFIDENTIAL AND YOUR ANSWERS WILL NEVER BE SHARED WITH ANYONE OTHER THAN OUR PROJECT TEAM.

MAY I START NOW?

- ☐ *Yes, permission is given* ⇨ *Go to HH18 to record the time and then begin the interview.*
- ☐ *No, permission is not given* ⇨ *Complete HH9. Discuss this result with your supervisor.*

After all questionnaires for the household have been completed, fill in the following information:	
HH8. Name of head of household: ________________________	
HH9. Result of household interview: Completed....01 No household member or no competent respondent at home at time of visit....02 Entire household absent for extended period of time....03 Refused....04 Dwelling vacant / Address not a dwelling....05 Dwelling destroyed....06 Dwelling not found....07 Other (*specify*)________________ 96	HH10. Respondent to household questionnaire: Name: ________________________ Line Number: ___ ___ HH11. Total number of household members: ___ ___
HH12. Number of women age 15-49 years: ___ ___	HH13. Number of woman's questionnaires completed: ___ ___
HH14. Number of children under age 5: ___ ___	HH15. Number of under-5 questionnaires completed: ___ ___

FIRST, PLEASE TELL ME THE NAME OF EACH PERSON WHO USUALLY LIVES HERE, STARTING WITH THE HEAD OF THE HOUSEHOLD.
List the head of the household in line 01. List all household members (HL2), their relationship to the household head (HL3), and their sex (HL4)
Then ask: ARE THERE ANY OTHERS WHO LIVE HERE, EVEN IF THEY ARE NOT AT HOME NOW?
If yes, complete listing for questions HL2-HL4. Then, ask questions starting with HL5 for each person at a time.
Use an additional questionnaire if all rows in the household listing form have been used.

HL1. *Line No.*	HL2. *Name*	HL3. WHAT IS THE RELATIONSHIP OF (*name*) TO THE HEAD OF HOUSEHOLD?	HL4. IS (*name*) MALE OR FEMALE? 1 Male 2 Female		HL5. WHAT IS (*name*)'S DATE OF BIRTH? 98 DK	9998 DK	HL6. HOW OLD IS (*name*)? *Record in completed years. If age is 95 or above, record '95'*
Line	Name	Relation*	M	F	Month	Year	Age
01		0 1	1	2	__ __	__ __ __ __	__ __
02		__ __	1	2	__ __	__ __ __ __	__ __
03		__ __	1	2	__ __	__ __ __ __	__ __
04		__ __	1	2	__ __	__ __ __ __	__ __
05		__ __	1	2	__ __	__ __ __ __	__ __
06		__ __	1	2	__ __	__ __ __ __	__ __
07		__ __	1	2	__ __	__ __ __ __	__ __
08		__ __	1	2	__ __	__ __ __ __	__ __
09		__ __	1	2	__ __	__ __ __ __	__ __
10		__ __	1	2	__ __	__ __ __ __	__ __
11		__ __	1	2	__ __	__ __ __ __	__ __
12		__ __	1	2	__ __	__ __ __ __	__ __
13		__ __	1	2	__ __	__ __ __ __	__ __
14		__ __	1	2	__ __	__ __ __ __	__ __
15		__ __	1	2	__ __	__ __ __ __	__ __

Tick here if additional questionnaire used ☐

* *Codes for HL3: Relationship to head of household:*

01 Head	06 Parent	11 Niece / Nephew
02 Wife / Husband	07 Parent-In-Law	12 Other relative
03 Son / Daughter	08 Brother / Sister	13 Adopted / Foster / Stepchild
04 Son-In-Law / Daughter-In-Law	09 Brother-In-Law / Sister-In-Law	14 Not related
05 Grandchild	10 Uncle / Aunt	98 Don't know

CHAPTER III. The effect of the Iraq War on fertility: A decomposition analysis [2]

3.1 Introduction

The increasing concern about the consequences of warfare for civilian populations has led to a growing body of demographic research. This research has been essential in providing estimates of war-induced excess mortality, a primary indicator by which to assess the intensity of wars and the adequacy of humanitarian responses.[3] Research on war-induced changes in fertility is much scarcer, although the need to monitor women's status and reproductive health in warzones has been widely acknowledged (Palmer, Lush and Zwi 1999; McGinn 2000; McGinn and Purdin 2004; Austin et al. 2008; McGinn 2009; Patel et al. 2009). This is especially evident in the case of the 2003–2011 Iraq War. Several studies have sought to quantify the impact of this war on mortality. See among others Roberts et al. (2004), Burnham et al. (2006), Alkhuzai et al. (2008), and Hagopian et al. (2013). By contrast, virtually nothing is known about the effect of this war on fertility.

This paper provides the first detailed account of recent fertility trends in Iraq, with a particular focus on the changes resulting from the war and the factors underlying them. The analysis is based on retrospective birth history data from the 2006 and 2011 Iraq Multiple Indicator Cluster Surveys (I-MICS). To assess the quality of the data, I calculate retrospective fertility rates from each survey by single calendar year and compare fertility estimates from one survey with the estimates for the same period from the subsequent

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[3] Since the early 2000s, a large number of studies on mortality in war-affected countries have been conducted. See for example Spiegel and Salama (2000) for Kosovo; Grein et al. (2003) for Angola; Tabeau and Bijak (2005) for Bosnia and Herzegovina; Roberts et al. (2001), Roberts et al. (2003) and Coghlan et al. (2006) for the Democratic Republic of Congo; Depoortere et al. (2004), Hagan and Palloni (2006) and Degomme and Guha-Sapir (2010) for Darfur; Roberts et al. (2004), Burnham et al. (2006), Alkhuzai et al. (2008), and Hagopian et al. (2013) for Iraq.

survey. I then pool the data to reconstruct annual fertility trends from 1997 to 2010, allowing for comparisons over a period spanning before and after the onset of the war. Using decomposition techniques, I quantify how much of the changes in fertility rates during wartime were accounted for by changes in the proportion of married women and how much by changes in the prevalence of birth control within marriage. The findings have implications for the design of women's empowerment and health strategies in Iraq and similar war-affected settings.

3.2 War and fertility

The number of studies assessing fertility changes during war in low- and middle-income countries is scant (Hill 2004; Guha-Sapir and D'Aoust 2010).[4] The limited existing evidence suggests that these changes vary not only in magnitude but even in direction, depending on the nature of the war and the pre-existing characteristics of the affected population.

War-induced fertility declines have been documented in a few sub-Saharan African countries during the 1980s and 1990s. These declines have been attributed to involuntary spousal separation and postponement of new marriages due to military mobilisation, accompanied in some cases by voluntary efforts to delay or avoid childbearing as a response to economic hardship. See Lindstrom and Berhanu (1999) for the Ethiopian civil war; Agadjianian and Prata (2002) for the Angolan civil war; Blanc (2004) and Woldemicael (2008) for Eritrea's border war against Ethiopia.

War-induced fertility increases have also been observed in some Middle Eastern countries during the same decades. These increases have been accounted for by a rise in

[4] Fertility declines in European countries during World War I and II are well-known. These declines were largely attributable to spousal separation and the drop in the number of new marriages due to conscription. See among others Vincent (1946), Hajnal (1947), Winter (1982), Festy (1984) and Chesnais (1992).

the proportion of young women married in response to security concerns and lack of alternatives, and from limited birth control within marriage owing to war-induced pronatalist ideologies and disruption of family planning services. See Khawaja (2000) for the first Palestinian Intifada; Abbasi-Shavazi et al. (2002) for Iran's war against Iraq; Yucesahin and Ozgugu (2008) for the Kurdish guerrilla in southeastern Turkey.

To date no study has assessed changes in fertility that may have resulted from more recent wars affecting the Middle East since the early 2000s, including the 2003–2011 Iraq War[5]. Fertility trends in Iraq during this war, as well as during the preceding period, have remained largely undocumented (Tabutin and Schoumaker 2005; Casterline 2009). It is likely that these trends have been affected by the country's turbulent history and associated population policies.

Saddam Hussein's regime embraced a strong pronatalist ideology since its inception in 1979. High fertility was encouraged through various economic incentives, including childbirth cash bonuses and family allowances (Faour 1989). The 1981–1988 war against Iran and the Iranian superiority in population size led Saddam Hussein to further intensify the regime's pronatalist approach, with the aim of accelerating population growth. Major restrictions on access to contraception were put in place, and penalties for performing illegal abortions were increased. Family planning services provided by the Iraqi Family Planning Association and the private sector were reserved exclusively for medical reasons (United Nations 1987; Efrati 1999). Only in the aftermath of the 1990–1991 Gulf War did the regime finally issue a decree allowing the provision of family planning services to all women. During the 1990s and early 2000s, the Iraqi Family Planning Association received

[5] The Iraq War began in March 2003 when US-led military forces invaded Iraq and removed Saddam Hussein's regime from power. Since then, the country has experienced insurgent and sectarian violence mostly targeting civilians. While insurgency and hostilities have continued, the departure of the last US forces in December 2011 is conventionally considered to mark the end of the war.

international assistance under a special dispensation from the UN embargo, but a contraceptive shortage persisted (United Nations 2001).[6]

The conditions prevailing during the 2003–2011 Iraq War are likely to have altered previous fertility trends in multiple, and possibly countervailing, ways. On the one hand, the regime change marked a turning point in the country's population policy. In the post-2003 period, family planning services have been actively supported by the government (United Nations 2011). The wider availability of birth control methods may have fostered a decline in the average number of children per woman. On the other hand, the post-2003 period has witnessed a deterioration in women's status as a result of widespread violence and rising conservatism (Brown and Romano 2006; UNICEF 2011). The dire security situation, combined with the resurgence of sectarian, tribal and generally conservative forces, has severely restricted women's possible roles outside the home and may have induced many to enter marriage and childbearing earlier than they might have in the absence of war.

The following analysis reveals how fertility changed during wartime and identifies the factors underlying these changes. The analysis excludes the autonomous Iraqi Kurdistan region, which experienced very different conditions. This region consists of the three northern governorates of Dohuk, Erbil and Al-Sulaimaniya, accounting for about 15 per cent of the Iraqi population. After the 1991 Kurdish uprising against Saddam Hussein's regime, these governorates became a de facto autonomous region under UN auspices. As a result, during the sanction period family planning methods were more easily available than elsewhere in the country. Unlike the rest of Iraq, this region witnessed virtually no combat

[6] Iraq's invasion of Kuwait in August 1990 led to the immediate imposition of a strict economic embargo by the UN Security Council. The embargo was maintained and extended after the Gulf War. The only imports permitted into Iraq were food, medicine, and other items classified as humanitarian aid. An Oil-for-Food Programme was approved by the UN Security Council in April 1995, allowing Iraq to sell oil to purchase humanitarian supplies under UN supervision. The embargo was lifted in May 2003.

during the 2003 US-led invasion and has not suffered from generalised violence and insecurity in the subsequent years. Annex A shows that fertility trends in Kurdistan were not altered after 2003.

3.3 Data

This study is based on retrospective birth history data from the 2006 and 2011 I-MICS. These nationally representative surveys were conducted by the Iraqi Central Organisation for Statistics and Information Technology and the Kurdistan Regional Statistics Office, in coordination with the Ministry of Health and with financial and technical support from UNICEF (Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007; 2013). In this section, I describe survey designs, implementations and response rates excluding the sample from the autonomous Iraqi Kurdistan region.

For the 2006 I-MICS, the country was divided into 47 domains, and 54 clusters were drawn from each domain with linear systematic probability proportional to size. A linear systematic sample of six households was selected within each cluster. Fieldwork took place between February and March 2006 and the household questionnaire was administrated to 15,085 of selected households, yielding a response rate of 99.2 per cent (Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007). For the 2011 I-MICS, 31 clusters were selected within each of the 85 Iraqi districts with linear systematic probability proportional to size and ten households were drawn from each cluster by systematic random sampling. Fieldwork was carried out between March and May 2011, reaching 25,984 households for a response rate of 99.7 per cent (Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2013).

In both surveys, the household questionnaire was administered to the head of each household for, among other purposes, gathering information regarding the age and sex of all household members. All women between the ages of 15 and 49 who were members of the selected households were eligible for the individual interview. Women's response rate was 99.1 per cent in the 2006 I-MICS and 98.6 per cent in the 2011 I-MICS. Retrospective birth histories were collected for all interviewed women who were ever-married at the date of the interview (see annex B).

Complete and accurate information regarding the birth date of women and the date of each of their live births is crucial for a correct estimation of fertility trends. In countries, like Iraq, with flawed vital registration systems, surveys collecting birth histories from a nationally representative sample of women are the most reliable sources for this purpose. Nevertheless, reporting errors are critical problems for many of these surveys (Potter 1977; Goldman et al. 1985; Arnold 1990; Marckwardt and Rutstein 1996; Pullum 2006; Schoumaker 2011; Pullum et al. 2013). Since these errors can distort fertility estimates, it is important to determine the quality of the data.

Both the 2006 and 2011 I-MICS are of good quality in terms of birth date completeness. Information regarding month and year of birth is complete for 95.6 per cent of interviewed women and 97.2 per cent of their reported live births in the 2006 I-MICS, and for 99.6 per cent of women and 99.5 per cent of reported live births in the 2011 I-MICS. However, complete reporting does not necessarily imply accurate reporting.

The two most widely mentioned and potentially serious problems with birth history data are omission and displacement of births (Pullum 2006; Sullivan et al. 2008; Schoumaker 2011; Pullum et al. 2013). A common error is the omission of births that occurred many years before the survey, especially in case of deceased children (Sullivan et al. 2008). Omission and displacement of recent births are also common and related to the design of the survey questionnaires. Like many similar surveys, the 2006 and 2011 I-MICS contained a child health module only for those women with children born up to five years before the survey. Previous research has found that interviewers are inclined to omit some recent births to avoid administering the lengthy health module (Schoumaker 2011). The same reason encourages interviewers to displace some recent births backward in time, particularly from the fifth year before the survey, which is the last year of eligibility for the health module, to the sixth year (Pullum 2006). These tactics tend to cause an underestimation of fertility in the five years preceding the surveys and an overestimation in the sixth year.

When two consecutive surveys are available, as they are here, an effective approach to detect omission and displacement of births and assess the overall reliability of the birth history data is to reconstruct retrospective fertility trends from each survey and compare fertility estimates from one survey with the estimates for the same period from the subsequent survey. In the absence of distortions resulting from data errors, I expect the 95 per cent confidence intervals of the estimated fertility rates from the 2006 and 2011 I-MICS to overlap. For a similar approach see Garenne (2008), Schoumaker (2009), Machiyama (2010), and Pullum et al. (2013).

3.4 Reconstructing fertility trends

Birth history data from the 2006 and 2011 I-MICS can be used to reconstruct annual fertility rates from 1997 to 2010. This makes it possible is to depict trends for a period spanning before and after the onset of the war. The fertility rate of women aged x in calendar year t is calculated as follows:

$$f_{x,t} = b_{x,t} / e_{x,t} \tag{1}$$

where $b_{x,t}$ is the number of births observed in calendar year t to women aged x at time of birth and $e_{x,t}$ is the number of women-years of exposure to risk at age x during year t. The 95 per cent confidence intervals for $f_{x,t}$ are derived from standard errors computed using the delta method (Pullum 2008; Schoumaker 2013). Because of truncation of the data on older women, the analysis of retrospective fertility rates is restricted to women aged 15–39. Since very few births occur to Iraqi women at age 40 and older, the downward bias of fertility due to the omission of this small fraction of births is negligible. Finally, it is important to state that these estimates are based on a sample of surviving women residing in Iraq at the time of the two surveys. Women who died or left the country during the war are thus excluded.

Figure 3.1a displays trends in the total fertility rate (TFR) for women aged 15–39 as estimated from the two surveys. Estimates from the 2011 I-MICS cover the period 2002–2010. The reason is that the oldest women whose birth histories were collected in the 2011 I-MICS were aged 49 at the date of the interview, and were therefore aged 39 ten years earlier. Birth histories from the 2006 I-MICS cover the period 1997–2005. Estimates from the two surveys agree closely with each other. Only for the year 2005, do the 95 per cent confidence intervals not overlap. The difference between the two TFRs in 2005 may result from both a slight underestimation of fertility in the year before the 2006 I-MICS, due to omission of births, and an overestimation of fertility in the sixth year before the 2011 I-MICS, due to displacement of births from the earlier period. Although the estimated TFR for 2005 must be treated with some caution, the difference between the two rates is not serious enough to distort the overall fertility trend, which is consistent between the two surveys.

Figure 3.1b shows the estimated trend in TFR using pooled data from the 2006 and 2011 I-MICS. Pooled fertility rates are obtained by summing the number of births from the two surveys in year *t* to women aged *x* at time of birth and dividing them by the sum of the number of women-years of exposure. Two noteworthy points emerge. First, total fertility in 2010 was still around 4.5 children per woman, which is fairly high compared to Iraq's neighbouring countries.[7] Second, the TFR remained remarkably stable, with apparently no change after the onset of the war. Total fertility in 2010 was exactly the same as in 1997, and annual fluctuations remained below 10 per cent over the entire period.

Figure 3.1a *TFRs for women aged 15–39, data from separate 2006 and 2011 I-MICS*

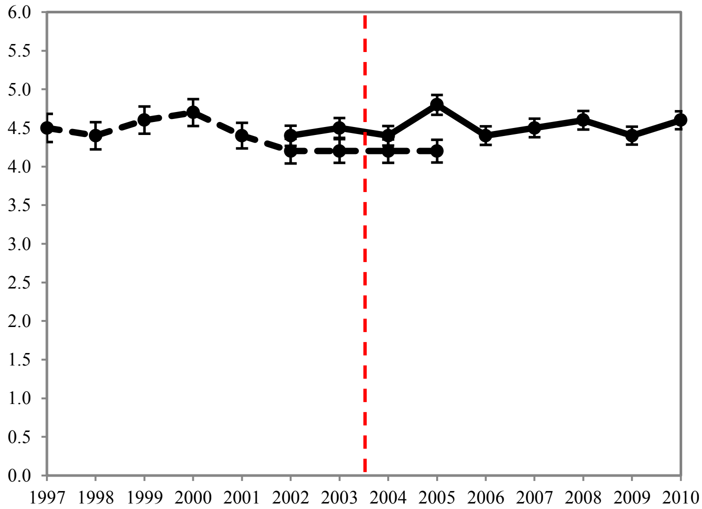
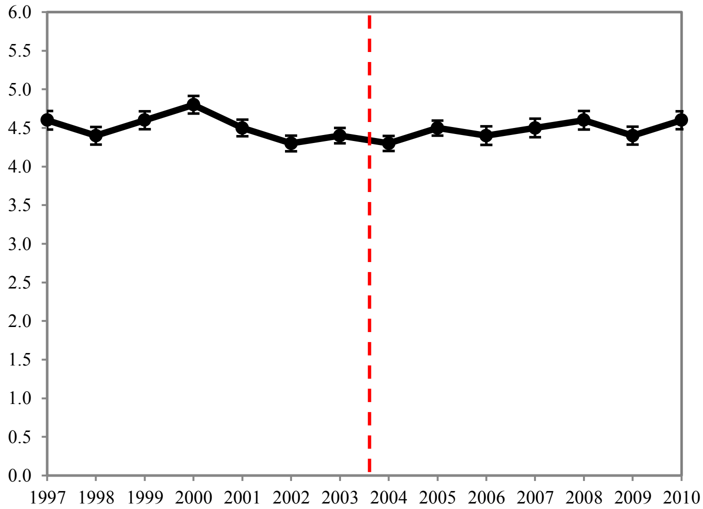


Figure 3.1b *TFRs for women aged 15–39, pooled data from 2006 and 2011 I-MICS*



Note: The dashed and solid lines in figure 3.1a are fertility estimates using data from the 2006 and 2011 I-MICS respectively. The estimates in figure 3.1b are obtained by pooling data from the two surveys.

[7] During the late 2000s, total fertility in Iraq's neighbouring countries ranged from about 2 to 3.5 children per women. See for example Abbasi-Shavazi et al. (2009) for fertility in Iran; Adbul Salam (2013) for Saudi Arabia; Al-Kandari (2007) for Kuwait; Cetorelli and Leone (2012) for Jordan; Yavuz (2005) for Turkey; Youssef (2012) for Syria.

However, the TFR reflects both the level and timing of fertility, and its stability over time can conceal underlying changes in the age patterns of childbearing. To uncover possible variations in fertility trends among women of different age groups, figure 3.2a displays age-specific fertility rates (ASFRs) from the 2006 and 2011 I-MICS. Birth histories from the 2011 I-MICS can be used to calculate retrospective fertility rates back to 1997 for the age groups 15–19, 20–24, 25–29 and 30–34. This means that, for these groups of women, the estimated ASFRs from the two surveys can be compared for nine years. Over this longer time period and at this less aggregate level, fertility trends are consistent. The 95 per cent confidence intervals of fertility estimates fail to overlap in 2005 only for the age groups 20–24 and 30–34. For all other age groups of women, and in particular for those aged 15–19, estimates from the two surveys agree remarkably well for all nine years.

Figure 3.2b presents the estimated ASFRs pooling data from the two surveys. This figure reveals that the stability of the TFR before and after the onset of the war was the result of countervailing fertility trends among younger and older women. To examine these trends in more detail, figure 3.3 displays the annual changes in ASFRs relative to the 1997 rates. The figure shows an abrupt shift in the timing of births toward younger ages. From 1997 to 2003, adolescent fertility was stable at just below 70 births per 1,000 girls aged 15–19. However, soon after the beginning of the war, adolescent fertility rose by more than 30 per cent reaching over 95 births per 1,000 girls in 2010. This increase is striking not only because it moved Iraq from moderate to high adolescent fertility[8], but also because a similar increase in adolescent fertility over such a short period has rarely been observed.[9]

[8] According to the United Nations, a country is classified as having a high rate of adolescent fertility if it has over 80 births per 1,000 girls aged 15-19 (United Nations 2013).

[9] A substantial increase in adolescent fertility was documented in the Palestinian Territories during the first Intifada (see Khawaja 2000).

The fertility rate of women aged 20–24 also increased after the onset of the war by about 15 per cent, from 200 to 230 births per 1,000 women in that age group. Only the fertility of women aged 25–29 remained virtually unchanged around 250 births per 1,000. The increase in early fertility was counterbalanced by a 15 per cent decline in the fertility of women aged 30–34, from 230 to 200 births per 1,000, and a 30 per cent decline among those aged 35–39, from 170 to 130 births per 1,000. It is noteworthy that the fertility rates of young women rose suddenly in the post-2003 period, whereas the declining fertility trends among older women were already underway a few years before the beginning of the war.

Figure 3.2a *ASFRs for women aged 15–39, data from separate 2006 and 2011 I-MICS*

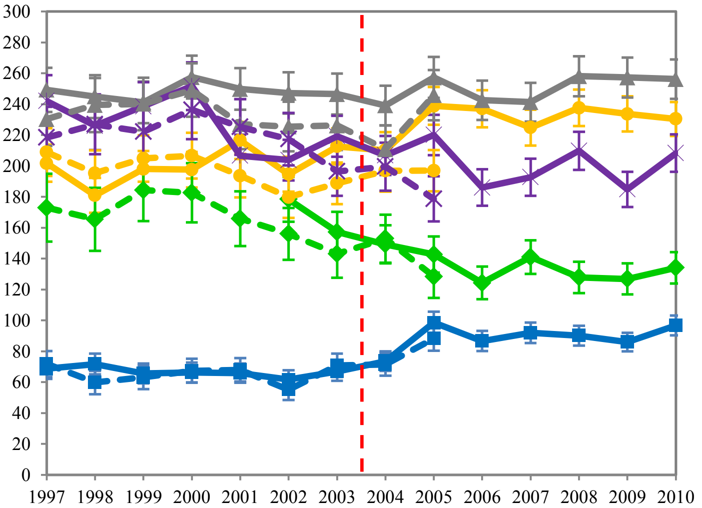
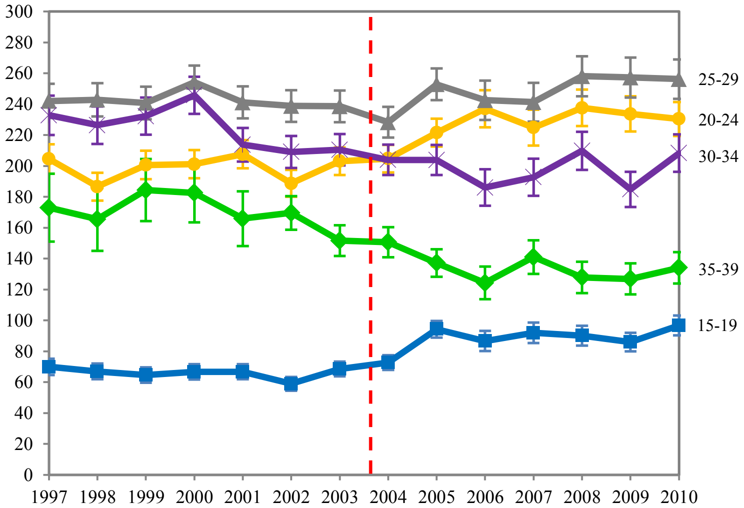
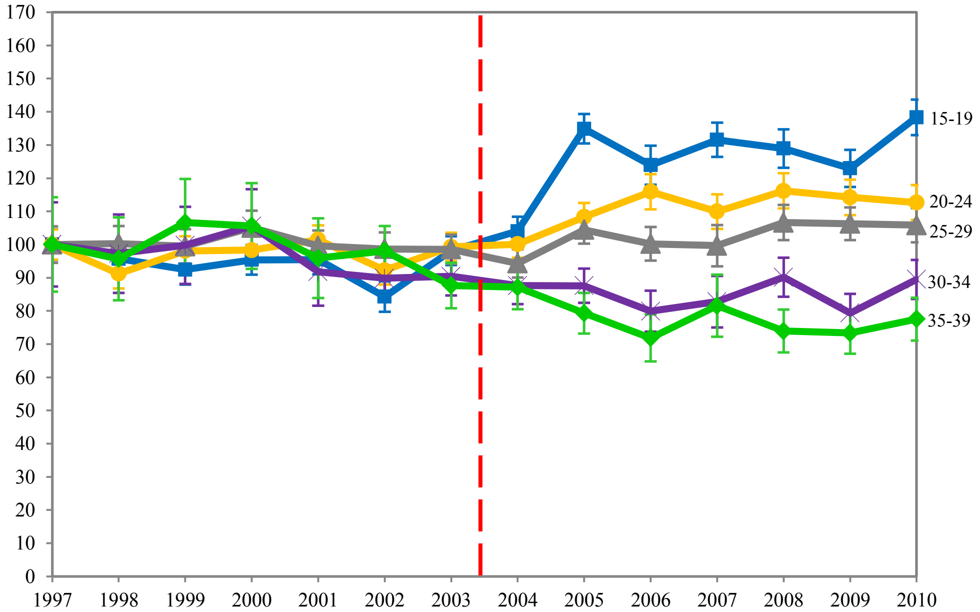


Figure 3.2b *ASFRs for women aged 15–39 , pooled data from 2006 and 2011 I-MICS*



Note: The dashed and solid lines in figure 3.2a are fertility estimates using data from the 2006 and 2011 I-MICS respectively. The estimates in figure 2b are obtained by pooling data from the two surveys.

Figure 3.3 *ASFRs for women aged 15–39 relative to 1997 rates (1997=100), pooled data from 2006 and 2011 I-MICS*



Note: The estimates in figure 3.3 are obtained by pooling data from the two surveys.

3.5 Distinguishing fertility trends by education

The abrupt rise in early fertility is most likely related to an increase in early marriage during the war. Virtually all births in Iraq occur within marriage, since extramarital childbearing is subject to strong cultural and religious sanctions. Once married, women are generally under social pressure to have children as soon as possible. Data from the 2006 and 2011 I-MICS confirm that only 1 per cent of married women use contraception before having at least one child.[10]

Previous research has found that in low- and middle-income countries women's education is the most important predictor of age at marriage and first birth. Having secondary education specifically is the factor most strongly associated with reduced prevalence of adolescent marriage and childbearing (Jain and Kurz 2007; Myers and

[10] The age-specific prevalence of modern contraceptive use ranges from 15 per cent among ever-married women aged 15-19 to over 45 per cent among those aged 35-39.

Harvey 2011). In what follows, I examine fertility differentials between women with no education or only primary schooling and women who attended (but did not necessarily completed) secondary or higher education. The aim is to determine whether there was a change in the age pattern of childbearing in one or both educational groups. According to the 2006 and 2011 I-MICS, the proportion of women with less than secondary education is around 55 per cent, with little variation across age groups.

Figure 3.4a shows annual trends in the education-specific TFR as estimated from the 2006 and 2011 I-MICS. Estimates are consistent between the two surveys, with overlapping 95 per cent confidence intervals except in the year 2005 for less-educated women. Trends using pooled data are reported in figure 3.4b. This figure reveals a significant educational gap in TFR, with less-educated women having on average 1.5 children more than highly educated women. The gap in total fertility between the two groups remained relatively constant over the entire period.

Figure 3.4a *Education-specific TFRs for women aged 15 –39, data from separate 2006 and 2011 I-MICS data*

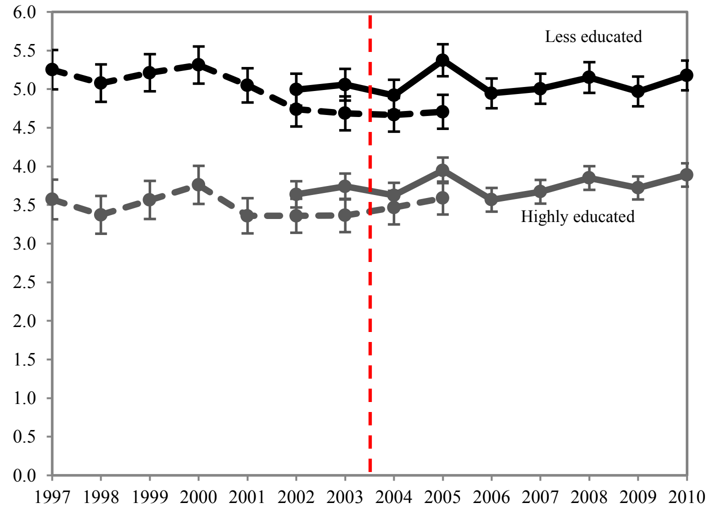
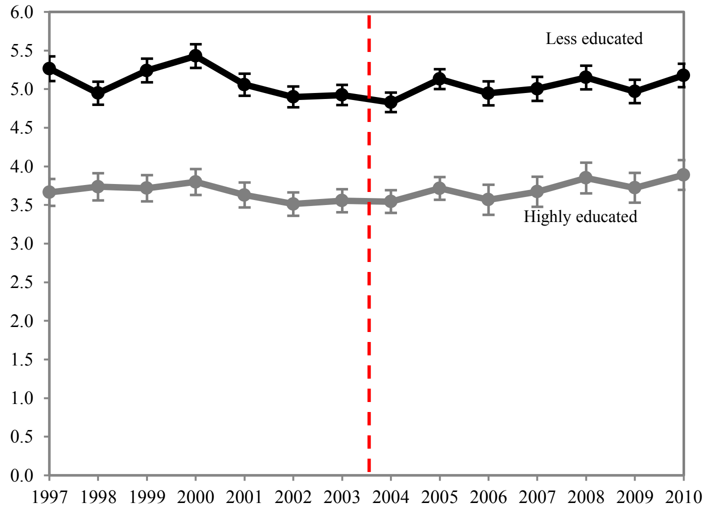


Figure 3.4b *Education-specific TFRs for women aged 15–39, pooled data from 2006 and 2011 I-MICS*



Note: The dashed and solid lines in figure 3.4a are fertility estimates using data from the 2006 and 2011 I-MICS respectively. The estimates in figure 3.4b are obtained by pooling data from the two surveys.

Once again this overall stability conceals very different trends in the age patterns of fertility between women with low and high education. Figure 3.5a presents ASFRs by survey for less-educated women. Estimates from the two surveys agree closely with each other. The 95 per cent confidence intervals of these estimates fail to overlap in the year 2005 only for women aged 30–34. Figure 3.5b shows estimates using pooled data, and figure 3.6 uses these estimates to display the annual changes in ASFRs relative to the 1997 rates. The shift in the timing of fertility towards younger ages was much more pronounced among women with less than secondary education than it appeared at the aggregate level.

Soon after the onset of the war, adolescent fertility rose by over 50 per cent, from about 85 to 135 births per 1,000 girls. Fertility increased by over 15 per cent among young adult women aged 20–24, from 230 to 270 births per 1,000, and remained stable among women aged 25–29 at around 270 births per 1,000. The fertility decline at older ages was also more pronounced among less-educated women than at the aggregate level. Fertility dropped by 20 per cent among women aged 30–34, from 260 to 220 births per 1,000, and by 40 per cent among those aged 35–39, from 190 to 135 births per 1,000.

The ASFRs for women with secondary or higher education by survey are reported in figure 3.7a. Fertility estimates for this group are more erratic because of the smaller number of births. Yet, the 95 per cent confidence intervals of these estimates overlap for all age groups over the entire period, except in 2000 and 2005 for women aged 20–24. Figure 3.7b shows the estimated ASFRs using pooled data, and figure 3.8 displays the relative changes in ASFRs compared to the 1997 rates. Before the war, highly educated women had lower fertility than less-educated women in all age groups. During the war, highly educated women did not experience any significant fertility change. Fertility fluctuated around 45 births per 1,000 among adolescents, 160 births per 1,000 among young adult women aged 20–24, 210 births per 1,000 among women aged 25–29, 180 births per 1,000 among those aged 30–34 and 130 births per 1,000 among those ages 35–39.

The shift towards early childbearing that occurred only among less-educated women led to a widening of fertility differentials by education among the youngest age groups, especially adolescents. In 2010 the contribution of adolescent fertility to the TFR among less-educated women was over 90 per cent higher than among highly educated women, whereas in 1997 it was just over 30 per cent higher. On the other hand, the educational gap in fertility at older ages gradually narrowed, and in 2010 less-educated women aged 35–39 had the same fertility rate as highly educated women in that age group.

Thus, a number of questions arise. What were the factors underlying the observed fertility changes among less-educated women? Was the sudden rise in fertility at younger ages determined by a higher prevalence of early marriage during the war? And what was the role of birth control use on falling fertility at older ages? The remainder of the paper seeks to answer these questions.

Figure 3.5a *ASFRs for less-educated women aged 15 –39, data from separate 2006 and 2011 I-MICS*

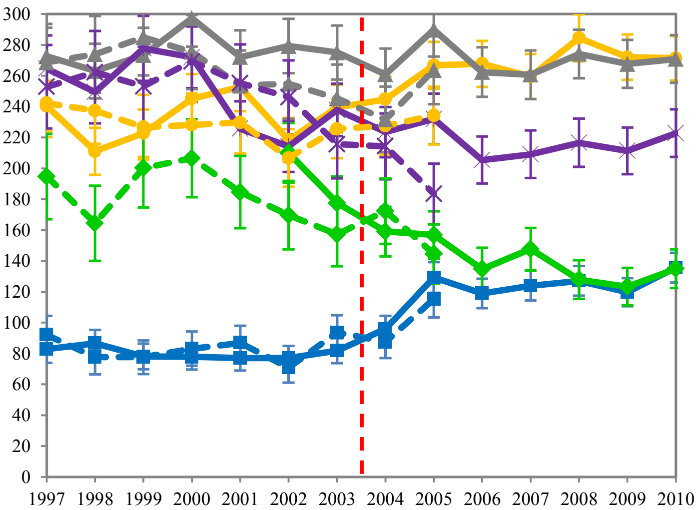
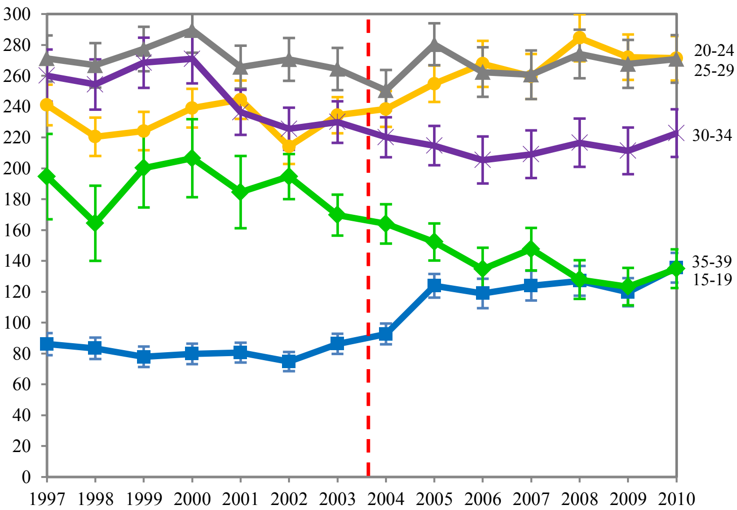
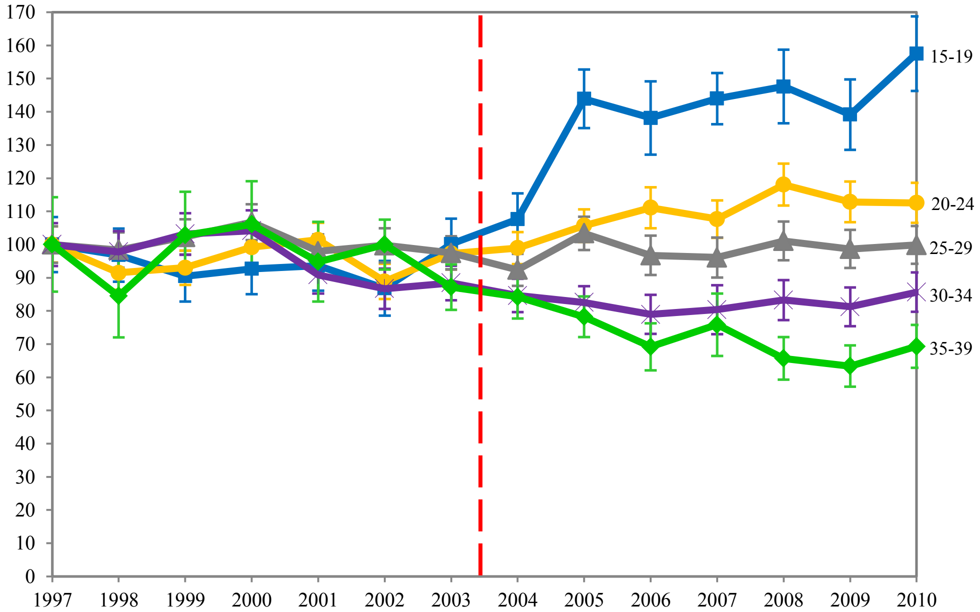


Figure 3. 5b *ASFRs for less-educated women aged 15–39, pooled data from 2006 and 2011 I-MICS*



Note: The dashed and solid lines in figure 3.5a are fertility estimates using data from the 2006 and 2011 I-MICS respectively. The estimates in figure 3.5b are obtained by pooling data from the two surveys.

Figure 3.6 *ASFRs for less-educated women aged 15–39 relative to 1997 rates (1997=100), pooled data from 2006 and 2011 I-MICS*



Note: The estimates in figure 3.6 are obtained by pooling data from the two surveys.

Figure 3.7a *ASFRs for highly educated women aged 15–39, data from separate 2006 and 2011 I-MICS*

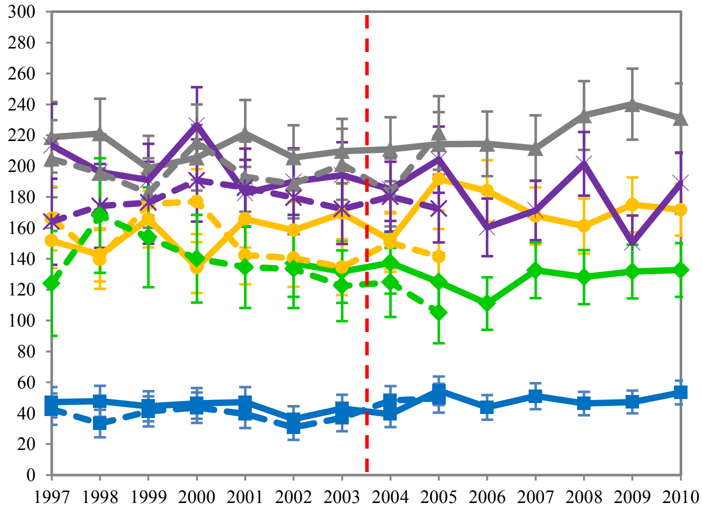
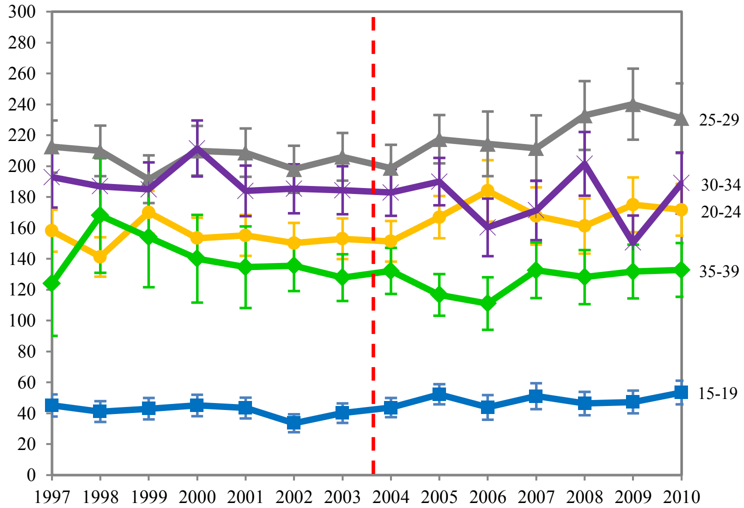
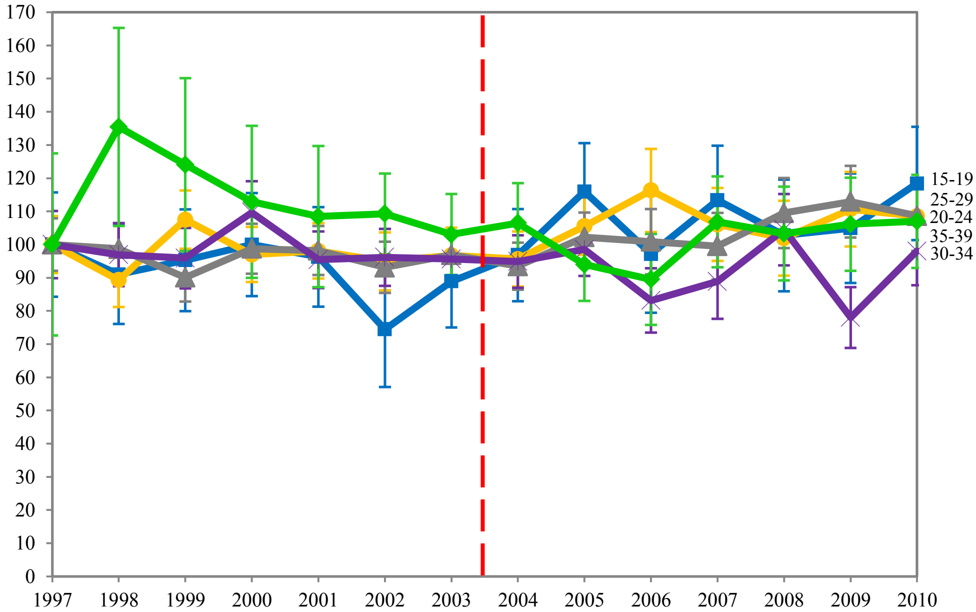


Figure 3.7b *ASFRs for highly educated women aged 15–39, pooled data from 2006 and 2011 I-MICS*



Note: The dashed and solid lines in figure 3.7a are fertility estimates using data from the 2006 and 2011 I-MICS respectively. The estimates in figure 3.7b are obtained by pooling data from the two surveys.

Figure 3.8 *ASFRs for highly educated women aged 15–39 relative to 1997 rates (1997=100), pooled data from 2006 and 2011 I-MICS*



Note: The estimates in figure 3.8 are obtained by pooling data from the two surveys.

3.6 Decomposing fertility changes among less-educated women

In this section, I quantify the relative contribution of marital composition and marital fertility to the observed fertility changes among less-educated women before and after the onset of the war. Under the assumption that all births occur within marriage, the fertility rate of women aged x in calendar year t can be rewritten as:

$$f_{x,t} = (b_{x,t} / e_{m,x,t}) * [e_{m,x,t} / (e_{s,x,t} + e_{m,x,t})] \qquad (2)$$

where $e_{m,x,t}$ are the number of women-years of exposure at age x during calendar year t that are spent married and $e_{s,x,t}$ are the number of women-years that are spent single, the sum of the two being equal to the total number of women-years $e_{x,t}$. In other words, the fertility rate of women of a given age in a given year is the product of the age-year-specific marital fertility rate $f_{m,x,t}$ and the age-year-specific proportion of women-years of exposure spent within marriage $p_{m,x,t}$:

$$f_{x,t} = f_{m,x,t} * p_{m,x,t} \quad (3)$$

Accordingly, the change in fertility rate from year *t* to *t+n* can be decomposed as:

$$f_{x,t+n} - f_{x,t} = [½(f_{m,x,t+n} + f_{m,x,t}) * (p_{m,x,t+n} - p_{m,x,t})] + [(f_{m,x,t+n} - f_{m,x,t}) * ½(p_{m,x,t+n} + p_{m,x,t})] \quad (4)$$

where the first of the two main components on the right side of equation 4 gives the proportion of the change in fertility rate stemming from change in marital composition, and the second component gives the proportion stemming from change in marital fertility.

This decomposition method was introduced by Kitagawa (1955) to decompose changes in crude birth rates and extended to fertility rates by Retherford and Ogawa (1978) and Reterford and Rele (1989). Since then, this method, with various adaptations, has been used extensively to analyse fertility changes over time in diverse populations. See for example Khawaja (2000), Lidstrom and Woubalem (2000), Retherford et al. (2005), Abbasi-Shavazi et al. (2009), and Gubhaju et al. (2013). I use equation 4 to decompose the observed fertility changes among less-educated women comparing the pre- and post-2003 period.

Table 3.1 displays age-specific percentages ever-married and marital fertility rates for less-educated women in the years 1997, 2003 and 2010. Estimates are based on pooled data from the 2006 and 2011 I-MICS. The use of ever-married rather than currently-married women in a specific calendar year is dictated by data availability. The 2006 and 2011 I-MICS collected information regarding the age at first marriage for all ever-married women, but did not ask about the duration of marriage for those who were divorced or widowed at the date of the interview.

From 1997 to 2003, marital exposure to fertility remained virtually identical for adolescents and young adult women. The percentages ever-married were around 21 per cent among those aged 15–19 in both years, and 57 per cent in 1997 and 56 per cent in

2003 for those aged 20–24. Among older age groups, the percentages ever-married declined slightly during this period, from around 79 per cent to 76 per cent among women aged 25–29, from 90 per cent to 84 per cent among those aged 30–34 and from 94 per cent to 92 per cent among those aged 35–39.

Meanwhile, marital fertility remained relatively stable among the youngest age groups, whereas it exhibited a clear declining trend at older ages. The fertility of married women aged 30–34 dropped from about 291 births per 1,000 in 1997 to 273 in 2003. The decline was more pronounced among those aged 35–39, from 208 to 184 births per 1,000. The fact that in 2003 married women were stopping childbearing earlier than they did in 1997 suggests that the fertility transition was underway, despite the prolonged pronatalist ideology of Saddam Hussein's regime and the contraceptive shortage in the country. Given the deterioration of living conditions during the embargo in the 1990s and early 2000s, this decline in the marital fertility of less-educated women may have been the result of economic hardship (Baram 2000).

The period 2003–2010 saw a sharp rise in marital exposure among the youngest age groups, with little change at older ages. The percentages ever-married increased from about 21 per cent to 32 per cent among adolescents, from 56 per cent to 70 per cent among women aged 20–24 and from 76 per cent to 85 per cent among those aged 25–29. The fact that the percentage ever-married at ages 35–39 remained relatively stable at around 90 per cent indicates that during the war women who would instead have married later in life entered marriage at much younger ages. As mentioned at the beginning of this paper, women's activities and possible roles outside the home were severely restricted after 2003 by security concerns and increased sectarianism and religious conservatism (Brown and Romano 2006; UNICEF 2011). The wider prevalence of early marriage compared to the pre-2003 period may therefore be essentially due to a paucity of alternatives for less-educated adolescents and young adult women.

The increase in marriage during the war was accompanied by a substantial drop in marital fertility across all age groups other than adolescents. This suggests that a larger number of married women were using contraception both to space births and to stop childbearing. The increased use of birth control within marriage was certainly facilitated by the wider availability of family planning information and services following the regime change in 2003. Nevertheless, it is likely that the reasons for falling marital fertility among less-educated women were still largely related to economic hardship. It is also possible that a fraction of this decline was the result of an increase in widowhood, divorce, and spousal separation during the war.

Results of the fertility decomposition analysis are provided in table 3.2. The first column summarises fertility changes among less-educated women during the period 1997–2003. Total fertility declined only slightly during this period from 5.3 children per woman in 1997 to 4.9 in 2003. Almost 90 per cent of this decline was accounted for by lower fertility among women aged 30–34 and 35–39. Fertility remained virtually unchanged at younger ages, especially among adolescents. The second and third columns shows that about half of the fertility decline among women aged 30–34 was accounted for by a reduction in marital exposure and about half by a reduction in marital fertility. For the age group 35–39, over 80 per cent of the decline was attributable to reduced marital fertility.

During the period 2003–2010, total fertility changed from 4.9 to 5.2 children per woman. This change was the result of two countervailing fertility trends: a fertility increase at younger ages and a continuation of fertility decline at older ages. Fertility in the age group 15–19 increased by 0.25 children per woman, with about 90 per cent of the increase resulting from a wider prevalence of adolescent marriage. In the age group 20–24 fertility increased by 0.18 children per woman. This increase was over-determined by a wider prevalence of marriage. Other things being equal, the rise in marriage among these women would have increased fertility by 0.28 children. However, the rise in marital exposure was partially offset by a reduction in marital fertility. The relative stability of fertility among women aged 25–29 was also the result of a combination of increased marital exposure and reduced marital fertility. On the other hand, the fertility decline in the age group 30–34 was over-determined by falling marital fertility, and the decline in the age group 35–39 was accounted for almost completely by falling marital fertility.

Table 3.1 *Marital composition and marital fertility among less-educated women, pooled data from 2006 and 2011 I-MICS*

	Percentages ever-married			**Marital fertility rates**		
Age groups	**1997**	**2003**	**2010**	**1997**	**2003**	**2010**
15–19	21.4	21.4	32.0	402.8	403.5	423.3
20–24	57.2	56.1	70.3	421.1	417.7	385.9
25–29	78.8	76.0	84.8	344.3	347.9	319.3
30–34	89.5	84.4	87.9	290.5	272.6	253.7
35–39	93.8	92.1	89.9	207.5	184.2	150.1
Total	63.2	60.9	67.6	8.3	8.1	7.7

Note: The estimates in table 3.1 are obtained by pooling data from the two surveys.

Table 3.2 *Decomposition of changes in the fertility rates of less-educated women into changes related to marital composition and to marital fertility, pooled data from 2006 and 2011 I-MICS*

	1997–2003			2003–2010		
Age groups	**Total change**	**Marital composition**	**Marital Fertility**	**Total change**	**Marital composition**	**Marital fertility**
15–19	0.00	0.00	0.00	0.25	0.22	0.03
20–24	-0.03	-0.02	-0.01	0.18	0.28	-0.10
25–29	-0.04	-0.05	0.01	0.03	0.14	-0.11
30–34	-0.15	-0.07	-0.08	-0.04	0.05	-0.08
35–39	-0.13	-0.02	-0.11	-0.18	-0.02	-0.16
Total	-0.35	-0.16	-0.19	0.25	0.67	-0.42

Note: The estimates in table 3.2 are obtained by pooling data from the two surveys.

3.7 Discussion

This study is the first detailed account of fertility changes in Iraq during the 2003–2011 war. I have shown that the apparent stability of the TFR at 4.5 children per woman was the result of two countervailing trends in age at marriage and marital fertility. On the one hand, the decline in marital fertility, which was already underway before 2003, accelerated during the war. The decline was mostly concentrated among less-educated women and was likely to have been poverty-driven. Living conditions in Iraq deteriorated during the embargo and have failed to improve after 2003. Nearly 25 per cent of Iraqis live below the poverty line and many families still rely on the public distribution system for basic food items (United Nations 2014; Rawaf et al. 2014). Birth control within marriage may have been fostered by the wider availability of family planning services following the regime change and the end of the embargo.

On the other hand, the post-2003 period has witnessed an abrupt shift in the timing of fertility towards younger ages. Adolescent fertility in particular increased dramatically after the onset of the war. This is the result of an increased prevalence of early marriage, most likely as a response to the dire security situation and rising conservatism throughout the country. Insecurity, especially the actual and perceived dangers of harassment, combined with the resurgence of sectarian, tribal and other conservatives forces prevent many women from participating in public life or even from leaving their homes without the escort of a male relative (Brown and Romano 2006; UNIFEM 2010). In this context young women may be induced to marry early by a lack of alternatives, while families may consider early marriage as the best way to protect their daughters and the family's honour. The prevalence of early marriage may have further increased after 2011, the result of a new escalation of insurgency and sectarian violence following the departure of the last US forces.

This trend is worrisome for several reasons. A large body of literature has demonstrated that women who marry when still adolescents tend to have a lower status in the home, less ability to influence decisions about their own lives and a higher risk of experiencing domestic violence (Jenson and Thornton 2003; Mathur et al. 2003; UNICEF 2005). Additionally, women who bear children when still adolescents face higher risks of maternal mortality and morbidity as well as poorer health outcomes for their children (Kurz 1997; Mathur et al. 2003; Save the Children 2013). The deleterious effects may be magnified by the fact that this phenomenon is concentrated among women with little education. The prevalence of early marriage and childbearing among women with secondary or higher education is relatively low and has not increased after 2003.

3.8 References

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3.9 Annex A

Fertility trends in the autonomous Iraqi Kurdistan region

The 2006 and 2011 I-MICS collected birth history data in the autonomous Iraqi Kurdistan region as well as in the rest of the country. For the 2006 I-MICS, the region was divided into nine domains. Like elsewhere, 54 clusters were drawn from each domain with linear systematic probability proportional to size and a linear systematic sample of six households was selected within each cluster. Fieldwork in the region took place between April and June 2006. The household questionnaire was administered to 2,788 of selected households, yielding a response rate of 95.8 per cent (Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007). For the 2011 I-MICS, 31 clusters were selected within the 33 Kurdish districts with a linear systematic probability proportional to size and ten households were drawn from each cluster by systematic random sampling. Fieldwork was carried out between February and March 2011, reaching 9,717 households for a response rate of 99.5 per cent (Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2013).

Survey data in this region are of similarly good quality as in the rest of Iraq. Women's response rate was 95.7 per cent in the 2006 I-MICS and 95.2 per cent in the 2011 I-MICS. Information regarding month and year of birth is complete for 97.5 per cent of interviewed women and 95.3 per cent of their reported live births in the 2006 I-MICS, and for 99.7 per cent of women and 97.8 per cent of reported live births in the 2011 I-MICS.

Figure A3.1a shows trends in the TFR for the Kurdistan region as estimated from the 2006 and 2011 I-MICS. The estimates from the two surveys agree closely with each other, with the 95 per cent confidence intervals overlapping in each year. Figure A3.1b displays the estimated trend in the TFR pooling data from the two surveys. Total fertility declined steeply, from an average rate of 5 children per woman in the late 1990s to 3 children per woman in 2010.

The ASFRs by survey are reported in figure A3.2a. Due to the small sample size, the trends are more erratic and the 95 per cent confidence intervals are larger than those presented previously for the rest of Iraq. Nevertheless, estimates from the two surveys are consistent for all age groups over the entire period. Figure A3.2b shows trends in ASFRs using pooled data, and figure A3.3 displays the annual changes in ASFRs relative to the 1997 rates. It is evident from these figures that fertility declined at a relatively similar pace across all age groups and fertility trends were not altered after 2003.

Figure A3.1a *TFRs for women aged 15–39 in Kurdistan, data from separate 2006 and 2011 I-MICS*

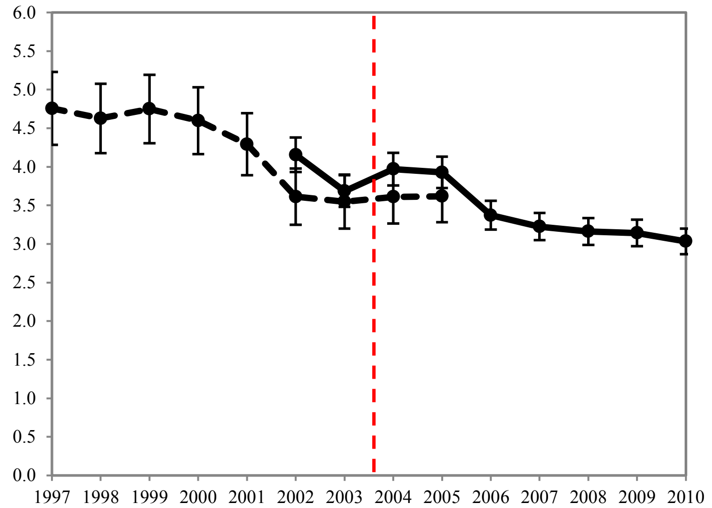
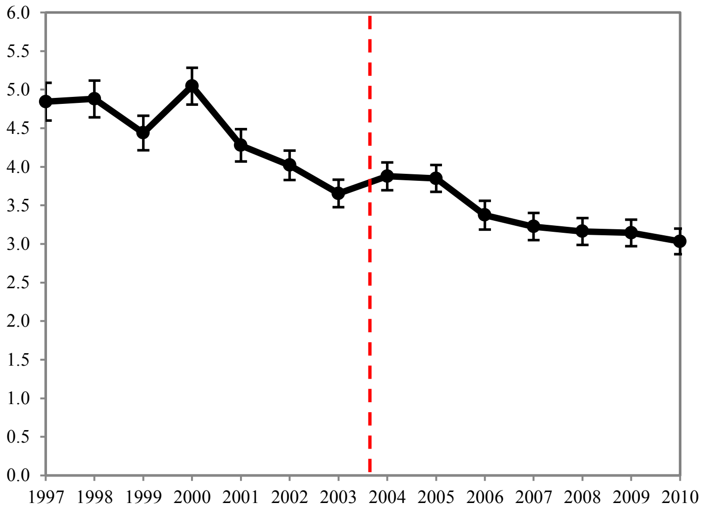


Figure A3.1b *TFRs for women aged 15–39 in Kurdistan, pooled data form 2006 and 2011 I-MICS*



Note: The dashed and solid lines in figure A3.1a are fertility estimates using data from the 2006 and 2011 I-MICS respectively. The estimates in figure A3.1b are obtained by pooling data from the two surveys.

Figure A3.2a *ASFRs for women aged 15–39 in Kurdistan, data from separate 2006 and 2011 I-MICS*

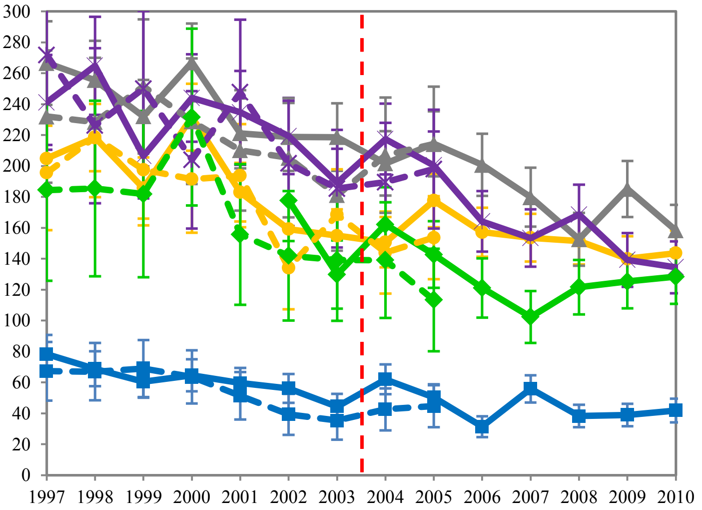
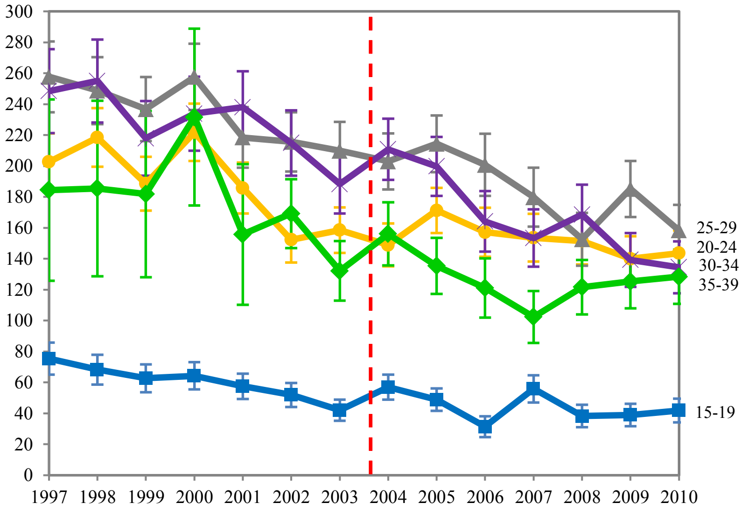
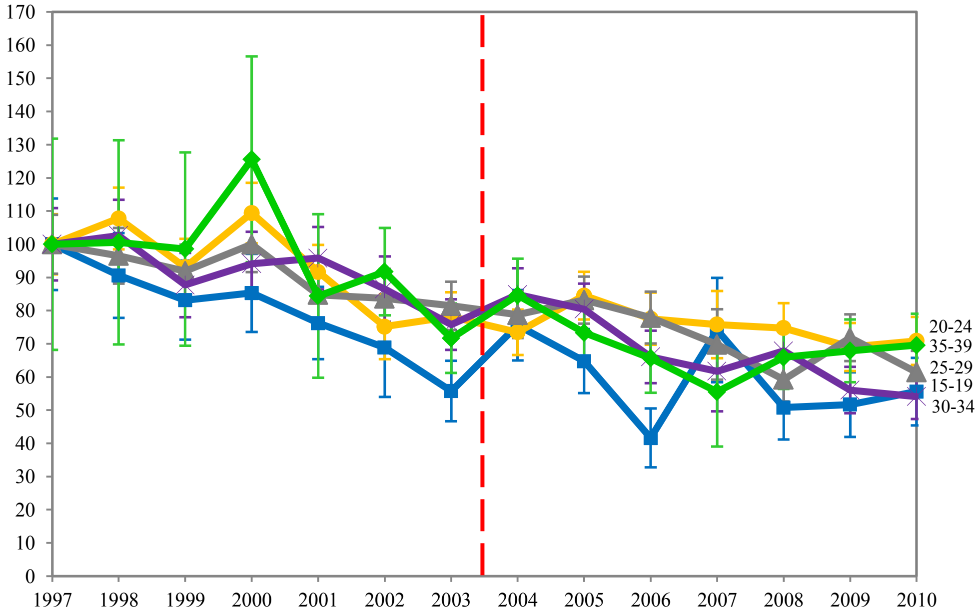


Figure A3.2b *ASFRs for women aged 15–39 in Kurdistan, pooled data from 2006 and 2011 I-MICS*



Note: The dashed and solid lines in figure A3.2a are fertility estimates using data from the 2006 and 2011 I-MICS respectively. The estimates in figure A3.2b are obtained by pooling data from the two surveys.

Figure A3.3 *ASFRs for women aged 15–39 in Kurdistan relative to 1997 rates (1997=100), pooled data from 2006 and 2011 I-MICS*



Note: The estimates in figure A3.3 are obtained by pooling data from the two surveys.

3.10 Annex B

MICS WOMAN'S INFORMATION PANEL	
This questionnaire is to be administered to all women age 15 through 49 (see Household Listing Form, column HL7). A separate questionnaire should be used for each eligible woman.	
WM1. Cluster number: ___ ___ ___	WM2. Household number: ___ ___
WM3. Woman's name: Name________________________	WM4. Woman's line number: ___ ___
WM5. Interviewer name and number: Name__________________ ___ ___	WM6. Day / Month / Year of interview: ___ ___ / ___ ___ / ___ ___ ___ ___

Repeat greeting if not already read to this woman:

WE ARE FROM (***country-specific affiliation***). WE ARE WORKING ON A PROJECT CONCERNED WITH FAMILY HEALTH AND EDUCATION. I WOULD LIKE TO TALK TO YOU ABOUT THESE SUBJECTS. THE INTERVIEW WILL TAKE ABOUT (***number***) MINUTES. ALL THE INFORMATION WE OBTAIN WILL REMAIN STRICTLY CONFIDENTIAL AND YOUR ANSWERS WILL NEVER BE SHARED WITH ANYONE OTHER THAN OUR PROJECT TEAM.

If greeting at the beginning of the household questionnaire has already been read to this woman, then read the following:

NOW I WOULD LIKE TO TALK TO YOU MORE ABOUT YOUR HEALTH AND OTHER TOPICS. THIS INTERVIEW WILL TAKE ABOUT (***number***) MINUTES. AGAIN, ALL THE INFORMATION WE OBTAIN WILL REMAIN STRICTLY CONFIDENTIAL AND YOUR ANSWERS WILL NEVER BE SHARED WITH ANYONE OTHER THAN OUR PROJECT TEAM.

MAY I START NOW?

☐ *Yes, permission is given* ⇨ *Go to WM10 to record the time and then begin the interview.*

☐ *No, permission is not given* ⇨ *Complete WM7. Discuss this result with your supervisor.*

WM7. Result of woman's interview	Completed .... 01 Not at home .... 02 Refused .... 03 Partly completed .... 04 Incapacitated .... 05 Other (*specify*)____________ 96

<table>
<tr><th colspan="3">WOMAN'S BACKGROUND</th></tr>
<tr><td>WB1. IN WHAT MONTH AND YEAR WERE YOU BORN?</td><td>Date of birth
Month .... __ __
DK month... 98

Year ....__ __ __ __
DK year .... 9998</td><td></td></tr>
<tr><td>WB2. HOW OLD ARE YOU?

Probe: HOW OLD WERE YOU AT YOUR LAST BIRTHDAY?

Compare and correct WB1 and/or WB2 if inconsistent</td><td>Age (in completed years)........................... __ __</td><td></td></tr>
<tr><td>WB3. HAVE YOU EVER ATTENDED SCHOOL OR PRESCHOOL?</td><td>Yes.. 1
No .... 2</td><td>
2⇨WB7</td></tr>
<tr><td>WB4. WHAT IS THE HIGHEST LEVEL OF SCHOOL YOU ATTENDED?</td><td>Preschool 0
Primary 1
Secondary 2
Higher .... 3</td><td>0⇨WB7</td></tr>
<tr><td>WB5. WHAT IS THE HIGHEST GRADE YOU COMPLETED AT THAT LEVEL?

If less than 1 grade, enter "00"</td><td>Grade .... __ __</td><td></td></tr>
<tr><td colspan="3">WB6. Check WB4:

☐ Secondary or higher. ⇨ Go to Next Module

☐ Primary ⇨ Continue with WB7</td></tr>
<tr><td>WB7. NOW I WOULD LIKE YOU TO READ THIS SENTENCE TO ME.

Show sentence on the card to the respondent. If respondent cannot read whole sentence, probe:

CAN YOU READ PART OF THE SENTENCE TO ME?</td><td>Cannot read at all.. 1
Able to read only parts of sentence.................. 2
Able to read whole sentence 3

No sentence in
required language ____________________ 4
(specify language)

Blind / visually impaired .... 5</td><td></td></tr>
</table>

MARRIAGE		
MA1. ARE YOU CURRENTLY MARRIED OR LIVING TOGETHER WITH A MAN AS IF MARRIED?	Yes, currently married ..... 1 Yes, living with a man ..... 2 No, not in union 3	3⇨MA5
MA2. HOW OLD IS YOUR HUSBAND/PARTNER? *Probe*: HOW OLD WAS YOUR HUSBAND/PARTNER ON HIS LAST BIRTHDAY?	Age in years ..... __ __ DK..... 98	
MA3. BESIDES YOURSELF, DOES YOUR HUSBAND/PARTNER HAVE ANY OTHER WIVES OR PARTNERS OR DOES HE LIVE WITH OTHER WOMEN AS IF MARRIED?	Yes ..... 1 No 2	2⇨MA7
MA4. HOW MANY OTHER WIVES OR PARTNERS DOES HE HAVE?	Number ..... __ __ DK..... 98	⇨MA7 98⇨MA7
MA5. HAVE YOU EVER BEEN MARRIED OR LIVED TOGETHER WITH A MAN AS IF MARRIED?	Yes, formerly married ..... 1 Yes, formerly lived with a man..... 2 No 3	3 ⇨Next Module
MA6. WHAT IS YOUR MARITAL STATUS NOW: ARE YOU WIDOWED, DIVORCED OR SEPARATED?	Widowed..... 1 Divorced..... 2 Separated..... 3	
MA7. HAVE YOU BEEN MARRIED OR LIVED WITH A MAN ONLY ONCE OR MORE THAN ONCE?	Only once..... 1 More than once 2	
MA8. IN WHAT MONTH AND YEAR DID YOU <u>FIRST</u> MARRY OR START LIVING WITH A MAN AS IF MARRIED?	Date of first marriage Month..... __ __ DK month ..... 98 Year..... __ __ __ __ DK year..... 9998	⇨Next Module
MA9. HOW OLD WERE YOU WHEN YOU STARTED LIVING WITH YOUR FIRST HUSBAND/PARTNER?	Age in years ..... __ __	

BIRTH HISTORY

NOW I WOULD LIKE TO RECORD THE NAMES OF ALL OF YOUR BIRTHS, WHETHER STILL ALIVE OR NOT, STARTING WITH THE FIRST ONE YOU HAD.
Record names of all of the births in BH1. Record twins and triplets on separate line. If there are more than 14 births, use an additional questionnaire.

BH Line No.	BH1. WHAT NAME WAS GIVEN TO YOUR (*first/next*) BABY?	BH2. WERE ANY OF THESE BIRTHS TWINS? 1 Single 2 Multiple	BH3. IS (*name*) A BOY OR A GIRL? 1 Boy 2 Girl	BH4. IN WHAT MONTH AND YEAR WAS (*name*) BORN? *Probe*: WHAT IS HIS/HER BIRTHDAY?		BH5. IS (*name*) STILL ALIVE? 1 Yes 2 No	BH6. HOW OLD WAS (*name*) AT HIS/HER LAST BIRTHDAY? *Record age in completed years.*	BH7. IS (*name*) LIVING WITH YOU? 1 Yes 2 No	BH8. *Record household line number of child (from HL1)* *Record "00" if child is not listed.*	BH9. *<u>If dead:</u>* HOW OLD WAS (*name*) WHEN HE/SHE DIED? *If "1 year", probe:* HOW MANY MONTHS OLD WAS (*name*)? *Record days if less than 1 month; record months if less than 2 years; or years*		BH10. WERE THERE ANY OTHER LIVE BIRTHS BETWEEN (*name of previous birth*) AND (*name*), INCLUDING ANY CHILDREN WHO DIED AFTER BIRTH? 1 Yes 2 No
Line	Name	S M	B G	Month	Year	Y N	Age	Y N	Line No	Unit	Number	Y N
01		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ Next Line	Days ....1 Months....2 Years......3	_ _	
02		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days ....1 Months....2 Years......3	_ _	1 Add Birth 2 Next Birth
03		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days ....1 Months....2 Years......3	_ _	1 Add Birth 2 Next Birth
04		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days ....1 Months....2 Years......3	_ _	1 Add Birth 2 Next Birth
05		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days ....1 Months....2 Years......3	_ _	1 Add Birth 2 Next Birth
06		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days ....1 Months....2 Years......3	_ _	1 Add Birth 2 Next Birth
07		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days ....1 Months....2 Years......3	_ _	1 Add Birth 2 Next Birth

BH Line No.	BH1. WHAT NAME WAS GIVEN TO YOUR (*first/next*) BABY?	BH2. WERE ANY OF THESE BIRTHS TWINS? 1 Single 2 Multiple	BH3. IS (*name*) A BOY OR A GIRL? 1 Boy 2 Girl	BH4. IN WHAT MONTH AND YEAR WAS (*name*) BORN? *Probe*: WHAT IS HIS/HER BIRTHDAY?		BH5. IS (*name*) STILL ALIVE? 1 Yes 2 No	BH6. HOW OLD WAS (*name*) AT HIS/HER LAST BIRTHDAY? *Record age in completed years.*	BH7. IS (*name*) LIVING WITH YOU? 1 Yes 2 No	BH8. *Record household line number of child (from HL1)* *Record "00" if child is not listed.*	BH9. *If dead:* HOW OLD WAS (*name*) WHEN HE/SHE DIED? *If "1 year", probe:* HOW MANY MONTHS OLD WAS (*name*)? *Record days if less than 1 month; record months if less than 2 years; or years*		BH10. WERE THERE ANY OTHER LIVE BIRTHS BETWEEN (*name of previous birth*) AND (*name*), INCLUDING ANY CHILDREN WHO DIED AFTER BIRTH? 1 Yes 2 No
08		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days …….1 Months….2 Years……3	_ _	1 Add Birth 2 Next Birth
09		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days …….1 Months….2 Years……3	_ _	1 Add Birth 2 Next Birth
10		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days …….1 Months….2 Years……3	_ _	1 Add Birth 2 Next Birth
11		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days …….1 Months….2 Years……3	_ _	1 Add Birth 2 Next Birth
12		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days …….1 Months….2 Years……3	_ _	1 Add Birth 2 Next Birth
13		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days …….1 Months….2 Years……3	_ _	1 Add Birth 2 Next Birth
14		1 2	1 2	_ _	_ _ _ _	1 2 ⇨ BH9	_ _	1 2	___ ___ ⇨ BH10	Days …….1 Months….2 Years……3	_ _	1 Add Birth 2 Next Birth

BH11. HAVE YOU HAD ANY LIVE BIRTHS SINCE THE BIRTH OF (*name of last birth in Birth History*)?	Yes .... No	1⇨Record Birth(s) in Birth History 2

CHAPTER IV. The impact of the Iraq War on neonatal polio immunisation coverage: A quasi-experimental study [11]

4.1 Introduction

It is well known that the 2003–2011 war undermined Iraq's already strained health care capacity and disrupted the delivery of basic health services, including routine immunisation (The Lancet 2013). However, the public health consequences of the war have remained difficult to quantify, mainly due to a scarcity of adequate data.

This paper assesses whether and to what extent the war affected neonatal polio immunisation coverage. The neonatal dose of oral polio vaccine (OPV) is particularly important for multiple reasons. A recent systematic review has confirmed its protective role for newborns in high risk countries, where early inducement of polio immunity is imperative. Since most newborns have maternally-derived antibody against poliovirus, a neonatal dose of OPV is associated with the lowest risk of serious adverse events, such as vaccine-associated paralytic polio. The priming effect of the neonatal dose can also increase the efficacy of subsequent doses administered later in childhood (Mateen et al. 2013).

This study relies on retrospective neonatal polio vaccination histories from the 2000, 2006 and 2011 Iraq Multiple Indicator Cluster Surveys (I-MICS). I identify the impact of the war using a quasi-experimental research design. Specifically, I adopt a difference-in-difference approach to contrast neonatal polio immunisation trends from 1996 to 2010 in the autonomous Kurdish governorates of Iraq, which remained relatively safe during the

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2003–2011 war, with trends in the central and southern governorates, where violence and disruption were pervasive. The research contributes to the assessment of the public health legacies of war, with important implications for the design of maternal and newborn health care strategies.

4.2 Polio immunisation services in Iraq

The Iraqi health care system was developed throughout the 1970s and 1980s, and used to be one of the most advanced in the Middle East (UNCEF 2003). The system was fully government-subsidised with revenues from the nationalised oil industry, and consisted of well-equipped health care facilities and adequate number of health service personnel (Foran 2008). During the 1980–1988 war against Iran, the Iraqi government adopted a set of policies to promote population growth, including a comprehensive child survival programme. As part of this programme, routine polio immunisation was made mandatory in 1985, and coverage increased considerably during the late 1980s (Hoskins 1997). Since then, according to the national immunisation schedule, each child should receive a first dose of OPV within two weeks from birth. Subsequent doses should be administrated at two, four and six months.

The 1990–1991 Gulf War and the following embargo and economic sanctions took a heavy toll on the country's health care capacity. During this period, public health budget was cut by 90 per cent, medical education and training were neglected, and buildings and equipment fell into disrepair (Alwan 2004). Routine immunisation services suffered a serious setback due to shortage of vaccine supply, poor maintenance of the cold chain, and general health service deterioration (UNICEF 1998; Al-Sheik et al. 1999; Frankish 2003).

The consequent decline in immunisation coverage led to a resurgence of vaccine-preventable diseases, including polio (Hoskins 1997).

To provide essential humanitarian needs and medical supplies, the UN Security Council approved the Oil-for-Food Programme in 1995. The programme was implemented by the Iraqi government in the central and southern governorates, and directly by the UN in the Kurdish governorates, which after the Gulf War had become a de facto autonomous region. From 1995, at least two national polio immunisation campaigns were held every year. As a result, by 2000 immunisation coverage recovered to the pre-1990s levels (UNICEF 2003).

In the first few months following the 2003 US-led military invasion, basic health services were paralysed by chaos, looting and destruction (Kapp 2003). More than 30 per cent of primary care clinics, 12 per cent of hospitals and 15 per cent of child care clinics were looted or damaged. Four of the seven central warehouses for the storage of drugs and supplies were partially looted. The two main public health laboratories were destroyed, and the Institute of Vaccine and Sera was stripped of equipment and furniture and lost its vaccine supply (Alwan 2004). The Disaster Assistance Response Team, UNICEF, and WHO were able to reactivate immunisation campaigns during the second half of 2003, but major constraints remained. These included inadequate vaccine supply, disruption of the cold chain, and the adverse security situation which impeded outreach efforts (Alwan 2004). From 2004 through 2007, the public health situation deteriorated further, due to escalating insurgent and sectarian violence (The Lancet 2007). In addition to the shortage of drugs and equipment, the violence-induced exodus of thousands of doctors and nurses seriously threatened the strained health system (Zarocostas 2007; Burnham et al. 2007). Even more recently, the Iraqi Ministry of Health has continued to face staggering challenges to the provision of basic health services, including routine immunisation, in the central and southern governorates (Al Hilfi et al. 2013; Webster 2013; Fernandez and Boulle 2013).

By contrast, the status of health system has improved in the autonomous Kurdish governorates. Unlike the rest of the country, these governorates remained relatively safe and experienced no significant increase in the number of violent deaths as a result of the war (Roberts et al. 2004; Burnham et al. 2006; Alkhuzai et al. 2008). Over the last decade, the Kurdish Ministry of Health has invested significantly in medical personnel and infrastructure. This has led to a widening gap in health care capacity between Kurdistan and central and southern Iraq (The Lancet 2013).

4.3 Data

The following analysis is based on retrospective neonatal polio immunisation histories from the 2000, 2006 and 2011 Iraq Multiple Indicator Cluster Surveys (I-MICS). The surveys were organised by the Iraqi Central Organisation for Statistics and Information Technology and the Kurdistan Regional Statistics Office, in cooperation with the Ministry of Health and with financial and technical support from UNICEF (Iraq Council of Ministers, Planning Commission and Central Statistical Organisation 2001; Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007; 2013).

Figure 4.1 shows the temporal relationship between these surveys and the 2003–2011 Iraq War. The first survey was carried out less than 3 years before the US-led military invasion. A multi-stage sampling procedure was adopted. A number of domains were selected within each district according to linear systematic probability proportionate to size. One cluster was drawn from each of the selected domains by simple random sampling, and ten households were selected within each cluster by systematic random sampling. Fieldwork took place between October and November 2000, and the survey questionnaires were successfully administrated to 99.2 per cent of selected households (N=13,011).

The second survey was conducted during the phase of most intense insurgent and sectarian violence. The country was divided into 56 domains, and 54 clusters were drawn from each of them with linear systematic probability proportional to size. A linear systematic sample of six households was selected within each cluster to allow the survey team to complete a full cluster in minimal time given the security concerns. Fieldwork in the central and southern governorates began in February 2006 and concluded in March. In the Kurdish governorates, fieldwork lasted from April until June 2006. Household response rate was 98.6 per cent (N=17,873).

The third survey was conducted during the final phase of the war. Within each district, 31 clusters were selected with linear systematic probability proportional to size, and ten households were drawn from each cluster by systematic random sampling. Fieldwork was carried out between February and March 2011 in the Kurdish governorates, and between March and May in central and southern Iraq. Questionnaires were administrated to 99.6 per cent of selected households (N=35,701).

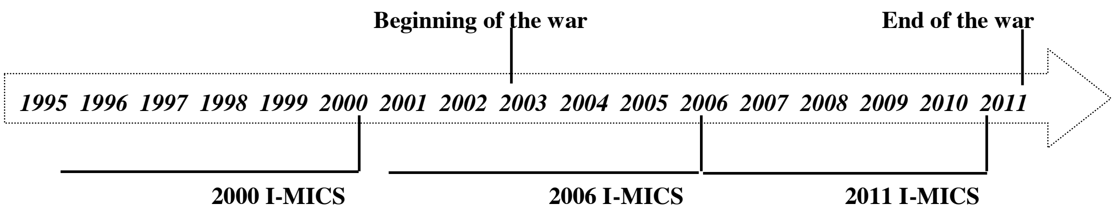
Immunisation histories were collected for all children under five years at the time of the surveys, using either vaccination cards or mothers' recall. Table 4.1 provides details regarding the number of children included in the analysis for Kurdistan, central and southern Iraq by year of birth (N=64,141). The percentages of children whose immunisation histories were obtained from vaccination cards were 50.7 per cent in 2000, 49.8 per cent in 2006 and 60.9 per cent in 2011. If the card was not available, mothers were asked to recall whether or not children had received each of the routine vaccinations, without however specifying when each vaccine was given. Only for the first dose of OPV did mothers were asked to specify whether children were immunised within two weeks from birth (see annex B). Pooling data from the three surveys makes it possible to reconstruct trends in neonatal polio immunisation for 15 years, from 1996 to 2010.

Table 4.1 *Number of children included in the analysis by region of residence and year of birth*

	No. of children		
Year of birth	**Kurdistan**	**Centre**	**South**
1996	344	969	1,404
1997	354	1,093	1,605
1998	351	973	1,459
1999	446	1,008	1,572
2000	355	952	1,377
2001	214	736	1,197
2002	443	1,109	1,586
2003	459	1,060	1,779
2004	483	1,117	1,894
2005	486	1,227	1,885
2006	1,168	1,625	2,252
2007	1,347	2,578	3,062
2008	1,371	2,813	3,058
2009	1,429	2,776	3,059
2010	1,391	3,029	3,246

Source: Author's calculations using pooled data from 2000, 2006 and 2011 I-MICS

Figure 4.1 *Timeline of war and retrospective neonatal polio immunisation histories*



Note: The war began in March 2003, when US-led military forces invaded Iraq, and officially ended in December 2011, when the last US troops left the country. The 2000 I-MICS was conducted before the beginning of the war, and included retrospective information on neonatal polio immunisation for children born between October 1995 and November 2000. The 2006 I-MICS was carried out during the most intense phase of the war and covered children born between February 2001 and June 2006. The 2011 I-MICS was administered during the final phase of the war and collected information for children born between February 2006 and May 2011.

4.4 Statistical analysis

The impact of war on neonatal polio immunisation is identified using a difference-in-difference approach. A key component of this quasi-experimental identification strategy is the selection of an appropriate counterfactual, which can be used to estimate what would have happened in the absence of war. This is typically done using a before and after comparison for an affected group of individuals relative to a control group (Angrist and Pischke 2009; Clayton and Hills 2002).

Children born in the Kurdish governorates, which remained relatively safe during the war, are used as a control group and compared with children born in the central and southern governorates, where violence and disruption were pervasive. The identifying assumption is that, in the absence of war, immunisation coverage in central and southern Iraq would have been affected by other time-varying factors in the same way as immunisation in Kurdistan. As shown in the following section, the validity of this 'common trend' assumption is supported by the similar immunisation coverage recorded in Kurdistan and the rest of Iraq from the mid-1990s to the beginning of the war.

The following linear probability model is adopted to estimate the effect of war on immunisation, while controlling for potential confounding factors. This allows for a straightforward interpretation of the difference-in-difference coefficient as the average causal effect of war. A binary response model is also fitted as a robustness check (Angrist and Pischke 2009).

$$Y_i = \beta' X_i + \gamma_t + \delta_j + \zeta W_{tj} + \varepsilon_i$$

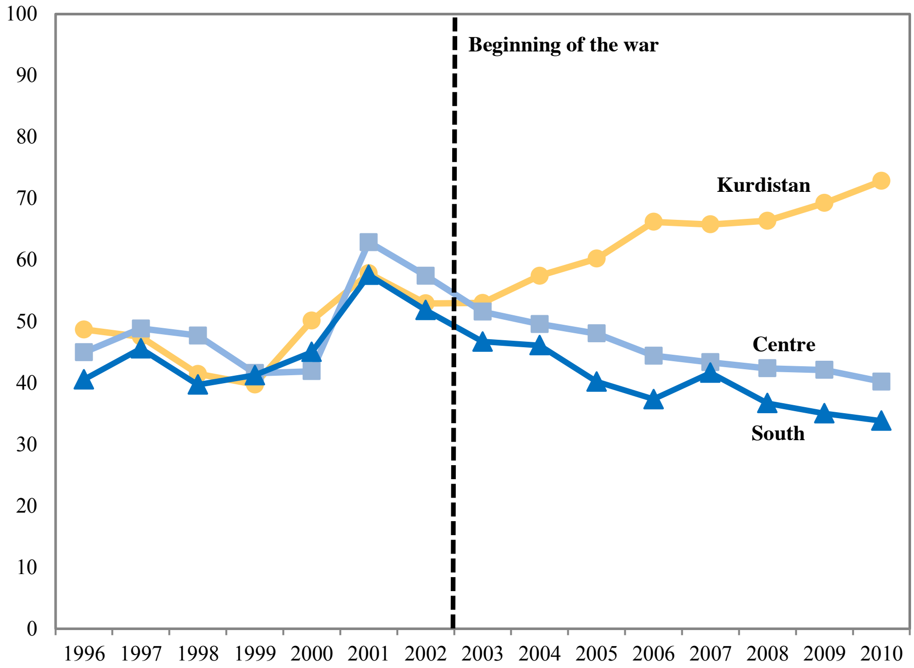
where Y_i is a binary outcome variable referring to neonatal polio immunisation status for child i. The variable is coded 1 if the child received a dose of OPV within two weeks from birth, and 0 otherwise. X_i is a vector of key individual and household characteristics available in the datasets that may influence immunisation, including child's sex (0 = male;

1 = female), mother's education (0 = no education; 1 = primary; 2 = secondary or more), and urban status (0 = rural; 1 = urban). γ_t are birth cohort fixed-effects that are defined by the year in which the child was born (1996 to 2010). δ_j are governorate fixed-effects that capture all time-invariant characteristics of the six central and nine southern governorates as well as the three Kurdish governorates (see figure 1.1 in chapter I). W_{tj} is a binary indicator for war exposure, coded 1 if the child was born during the war in an affected governorate, and 0 otherwise. The associated coefficient ζ estimates the difference in the probability of being immunised between children exposed to the war and non-exposed children. ε_i is a random, idiosyncratic error term. To account for possible correlations among error terms of children living in the same governorate, the confidence intervals of regression coefficients are derived from robust standard errors clustered at the governorate level (Bertrard et al. 2004).

4.5 Results

Figure 4.2 shows changes in neonatal polio immunisation coverage from 1996 to 2010 for Kurdistan, central and southern Iraq. During the pre-war period, from 1996 to 2002, immunisation coverage in the three regions followed a common trend. The percentage of children receiving a dose of OPV within two weeks from birth fluctuated between 40 and 50 per cent in the late 1990s. Coverage began to rise in 2000 and reached approximately 60 per cent in 2001. After the 2003 US-led military invasion, the percentage of immunised children continued to rise in Kurdistan exceeding 70 per cent in 2010. By contrast, in central and southern Iraq immunisation coverage declined during the war and in 2010 it was well below the early-2000s level. The diverging trends between Kurdistan and the rest of Iraq for the post-2003 period provide preliminary evidence of the adverse effect of war on immunisation coverage.

Figure 4.2 *Trends in neonatal polio immunisation coverage (%) by region and year*



Source: Author's calculations using pooled retrospective neonatal polio immunisation histories from 2000, 2006 and 2011 I-MICS

Table 4.2 presents estimates from difference-in-difference regressions that quantify the impact of war on the probability of being immunised, while controlling for individual and household characteristics, year of birth and governorate fixed-effects. Coefficients for the linear probability model are reported in the first column. On average, children exposed to the war were 21.5 percentage points less likely to receive a dose of OPV within two weeks from birth compared with non-exposed children. The magnitude of this effect is large, especially if compared with the mean immunisation coverage before the onset of the war.

As it is generally the case in low- and middle-income countries, the probability of being immunised varied significantly with household characteristics. Children whose mothers had primary and secondary education were respectively 5.6 and 9.8 percentage points more likely to be immunised compared with children whose mothers were illiterate. Children residing in urban areas were 5.3 percentage points more likely to be immunised compared with children in rural areas. Female children were as likely to be immunised as male children. This is consistent with previous research documenting the absence of gender disparities in immunisation coverage across the Arab region (Khawaja et al. 2008). Interaction terms between these individual and household characteristics and the war exposure variable were examined and none was significant (see annex A).

As a robustness check, average marginal effects for a logistic model are reported in the second column of table 4.2. The estimated effect of war is virtually the same as that obtained from the linear probability model. Children exposed to the war are estimated to be 20.8 percentage points less likely to have received a neonatal dose of OPV compared with non-exposed children. The effects of the other covariates also maintain the same magnitude and significance as in the linear probability model.

Table 4.2 *Probability of receiving a dose of OPV within two weeks from birth*

Explanatory variables	Linear probability model - Coefficients	Logistic model - Average marginal effects
War exposure		
No (ref. category)	-	-
Yes	-0.215*** (-0.341, -0.089)	-0.208*** (-0.311, -0.105)
Sex		
Male (ref. category)	-	-
Female	-0.003 (-0.014, 0.009)	-0.003 (-0.013, 0.008)
Mother's education		
None (ref. category)	-	-
Primary	0.056*** (0.035, 0.076)	0.056*** (0.036, 0.076)
Secondary	0.098*** (0.069, 0.126)	0.098*** (0.072, 0.124)
Place of residence		
Rural (ref. category)	-	-
Urban	0.053*** (0.034, 0.071)	0.053*** (0.035, 0.070)
Year fixed-effects	Yes	Yes
Governorate fixed-effects	Yes	Yes

Source: Author's calculations using pooled data from 2000, 2006 and 2011 I-MICS.

Notes: *** p-value<0.01. The 95 per cent confidence intervals in parentheses are derived from robust standard errors clustered at the governorate-level.

4.5 Discussion

A number of studies have documented insufficient child immunisation coverage in war zones. Robertson et al. (1993) found poor immunisation coverage during the Bosnian war, in 1993. The authors could not access any data for the pre-war period, but anecdotal reports from public health institutions and primary health care physicians suggested that before the war most children were fully immunised. Agadjanian and Prata (2003) showed that in 1996, during the Angolan Civil War, the country's level of age-adequate immunisation was lower than in most of sub-Saharan Africa. A significant disadvantage of children residing in areas more affected by fighting was also detected. Senessie et al. (2007) collected data in the Greater Freetown area in 1998–1999, during the Sierra Leone Civil War. For most children immunisation was inadequate for their age and was often delayed during periods of increased hostilities. Mashal et al. (2007) examined changes in immunisation coverage between 2000 and 2003 in Afghanistan. Although progress was observed in all regions of the country, the authors found that the most insecure areas had lower immunisation coverage regardless of the available resources for immunisation services.

Lack of data over longer time periods prevented previous studies from assessing causality and determining to what extent poor immunisation coverage was attributable to war-related disruption or to pre-existing trends. Relying on retrospective neonatal polio vaccination histories from three consecutive surveys, this paper is the first to quantify the effect of the 2003–2011 Iraq War on immunisation trends, and to provide causal inference regarding the nature of this effect. After dropping dramatically in the aftermath of the Gulf War, neonatal polio immunisation coverage was recovering during the early 2000s. In the autonomous Kurdish governorates, the status of health services continued to improve during the last decade and neonatal polio immunisation coverage increased considerably, exceeding 70 per cent in 2010. By contrast, in central and southern Iraq coverage declined again during the recent war, and in 2010 less than 40 per cent of children were immunised within two weeks from birth. Difference-in-difference regressions demonstrate that children exposed to the war were over 20 percentage points less likely to receive neonatal polio immunisation compared with non-exposed children, even after controlling for individual and household characteristics, year of birth and governorate of residence.

Using retrospective immunisation histories for the difference-in-difference analysis has a number of limitations. In particular, the effect of war might be somewhat overestimated or underestimated as a result of endogenous migration, fertility, and mortality. If for instance children from better-off households were more likely to flee the war, the reduction in neonatal polio immunisation coverage would be in part due to a change in the population composition of war-affected governorates. Similarly, the effect of war on immunisation coverage would be overestimated if better-off women were less likely to give birth during the war. However, an opposite source of bias could be due to differences in child mortality. The effect of war would be underestimated if children with no access to basic health services during the war were more likely to die and therefore not to be included in the sample.

This study confirms previous reports documenting that since 2003 pervasive violence and disruption have restricted access to primary health care facilities and, at the same time, reduced the quality of services provided in such facilities (Al Hilfi et al. 2013; Webster 2013; Fernandez and Boulle 2013). The decline in neonatal polio immunisation coverage in central and southern Iraq is therefore part of a broader war-induced deterioration in the country's health care capacity. The findings of this study highlight urgent need to enhance the provision of comprehensive maternal and newborn health services. In particular, promoting institutional deliveries and ensuring adequate vaccine availability in primary health care facilities could increase dramatically the percentage of newborns immunised.

4.6 References

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4.7 Annex A

Models with interaction terms

Tables A4.1 to A4.3 display results from difference-in-difference linear probability models including interaction terms between the war exposure variable and individual and household characteristics. None of these interactions is significant, meaning that the war had an adverse effect on the probability of neonatal polio immunisation independently from child's sex, mother's education and urban or rural residence.

Table A4.1 *Probability of receiving a dose of OPV within two weeks from birth – Model including interaction term between war and child's sex variables*

Explanatory variables	**Linear probability model - Coefficients**
War exposure	
No (ref. category)	-
Yes	-0.217*** (-0.346, -0.087)
Sex	
Male (ref. category)	-
Female	-0.004 (-0.021, 0.012)
Mother's education	
None (ref. category)	-
Primary	0.056*** (0.035, 0.076)
Secondary	0.098*** (0.069, 0.126)
Place of residence	
Rural (ref. category)	-
Urban	0.053*** (0.034, 0.071)
War * Sex	0.003 (-0.015, 0.022)
Year fixed-effects	Yes
Governorate fixed-effects	Yes

Source: Author's calculations using pooled data from 2000, 2006 and 2011 I-MICS.

Notes: *** p-value<0.01. The 95 per cent confidence intervals in parentheses are derived from robust standard errors clustered at the governorate-level.

Table A4.2 *Probability of receiving a dose of OPV within two weeks from birth - Model including interaction term between war and mother's education variables*

Explanatory variables	**Linear probability model - Coefficients**
War exposure	
No (ref. category)	-
Yes	-0.222*** (-0.349, -0.095)
Sex	
Male (ref. category)	-
Female	-0.003 (-0.014, 0.009)
Mother's education	
None (ref. category)	-
Primary	0.060*** (0.029, 0.090)
Secondary	0.107*** (0.080, 0.133)
Place of residence	
Rural (ref. category)	-
Urban	0.053*** (0.034, 0.071)
War * Mother's education 1	0.017 (-0.024, 0.058)
War * Mother's education 2	0.008 (-0.167, 0.032)
Year fixed-effects	Yes
Governorate fixed-effects	Yes

Source: Author's calculations using pooled data from 2000, 2006 and 2011 I-MICS.

Notes: *** p-value<0.01. The 95 per cent confidence intervals in parentheses are derived from robust standard errors clustered at the governorate-level.

Table A4.3 *Probability of receiving a dose of OPV within two weeks from birth - Model including interaction term between war and place of residence variables*

Explanatory variables	**Linear probability model - Coefficients**
War exposure	
No (ref. category)	-
Yes	-0.196*** (-0.327, -0.065)
Sex	
Male (ref. category)	-
Female	-0.003 (-0.014, 0.009)
Mother's education	
None (ref. category)	-
Primary	0.055*** (0.035, 0.076)
Secondary	0.098*** (0.070, 0.126)
Place of residence	
Rural (ref. category)	-
Urban	0.072*** (0.051, 0.093)
War * Place of residence	-0.035 (-0.072, 0.003)
Year fixed-effects	Yes
Governorate fixed-effects	Yes

Source: Author's calculations using pooled data from 2000, 2006 and 2011 I-MICS.

Notes: *** p-value<0.01. The 95 per cent confidence intervals in parentheses are derived from robust standard errors clustered at the governorate-level.

Robustness check contrasting central governorates with southern governorates

As a robustness check, the same difference-in-difference model was run contrasting the central governorates with the southern governorates, while excluding the Kurdish governorates. Table A4.3 reports estimates from a linear probability model in which the sample from Kurdistan was excluded and the war exposure variable war recoded as if the southern governorates were not affected by the war. The coefficient of this variable is not statistically significant, confirming that the war had the same adverse effect on the probability of neonatal polio immunisation in both central and southern Iraq.

Table A4.3 *Probability of receiving a dose of OPV within two weeks from birth - Robustness check contrasting central governorates with southern governorates*

Explanatory variables	**Linear probability model - Coefficients**
War exposure	
No (ref. category)	-
Yes	-0.057 (-0.187, 0.074)
Sex	
Male (ref. category)	-
Female	-0.003 (-0.015, 0.010)
Mother's education	
None (ref. category)	-
Primary	0.064*** (0.041, 0.087)
Secondary	0.104*** (0.071, 0.138)
Place of residence	
Rural (ref. category)	-
Urban	0.047*** (0.026, 0.068)
Year fixed-effects	Yes
Governorate fixed-effects	Yes

Source: Author's calculations using pooled data from 2000, 2006 and 2011 I-MICS.

Notes: *** p-value<0.01. The 95 per cent confidence intervals in parentheses are derived from robust standard errors clustered at the governorate-level.

Household fixed-effect model (period 2001–2005 only)

Some of the households who were interviewed in the 2006 I-MICS had multiple children under five years, with some children born before the war (2001–2002) and others born during the war (2003–2005). This provides an opportunity to estimate the impact of the war comparing neonatal polio immunisation of exposed and non-exposed siblings:

$$Y_i = \beta' X_i + \gamma_t + \theta_h + \zeta W_{th} + \varepsilon_{ith}$$

where θ_h are household fixed-effects accounting for all time-invariant characteristics that are common to siblings within the household. In this equation, W_{th} is a binary indicator for exposure coded 1 if the child was born during the war in an affected household, and 0 otherwise. The associated coefficient ζ estimates the difference in the probability of being immunised between children exposed to the war and non-exposed siblings.

Results are presented in table A4.4. Children born during the war (2003–2005) in an affected household were less likely to receive a dose of oral polio vaccine within two weeks from birth compared to siblings that were not exposed to the war.

Table A4.4 *Probability of receiving a dose of OPV within two weeks from birth Model with household fixed-effects (period 2001–2005 only)*

Explanatory variables	**Linear probability model - Coefficients**
War exposure	
No (ref. category)	-
Yes	-0.130*** (-0.167, -0.092)
Sex	
Male (ref. category)	-
Female	-0.008 (-0.014, 0.030)
Year fixed-effects	Yes
Household fixed-effects	Yes

Source: Author's calculations using data from 2006 I-MICS.

Notes: *** p-value<0.01. The 95 per cent confidence intervals in parentheses are derived from robust standard errors clustered at the governorate-level.

4.9 Annex B

MICS UNDER-FIVE CHILD INFORMATION PANEL	
This questionnaire is to be administered to all mothers or caretakers (see Household Listing Form, column HL9) who care for a child that lives with them and is under the age of 5 years (see Household Listing Form, column HL6). A separate questionnaire should be used for each eligible child.	
UF1. Cluster number: ___ ___ ___	UF2. Household number: ___ ___
UF3. Child's name: Name_______________	UF4. Child's line number: ___ ___
UF5. Mother's / Caretaker's name: Name_______________	UF6. Mother's / Caretaker's line number: ___ ___
UF7. Interviewer name and number: Name_______________ ___ ___	UF8. Day / Month / Year of interview: ___ ___ / ___ ___ / ___ ___ ___ ___

Repeat greeting if not already read to this respondent:

WE ARE FROM (***country-specific affiliation***). WE ARE WORKING ON A PROJECT CONCERNED WITH FAMILY HEALTH AND EDUCATION. I WOULD LIKE TO TALK TO YOU ABOUT (*name*)'S HEALTH AND WELL-BEING. THE INTERVIEW WILL TAKE ABOUT (***number***) MINUTES. ALL THE INFORMATION WE OBTAIN WILL REMAIN STRICTLY CONFIDENTIAL AND YOUR ANSWERS WILL NEVER BE SHARED WITH ANYONE OTHER THAN OUR PROJECT TEAM.

If greeting at the beginning of the household questionnaire has already been read to this person, then read the following:

NOW I WOULD LIKE TO TALK TO YOU MORE ABOUT (***child's name from UF3***)'S HEALTH AND OTHER TOPICS. THIS INTERVIEW WILL TAKE ABOUT (***number***) MINUTES. AGAIN, ALL THE INFORMATION WE OBTAIN WILL REMAIN STRICTLY CONFIDENTIAL AND YOUR ANSWERS WILL NEVER BE SHARED WITH ANYONE OTHER THAN OUR PROJECT TEAM.

MAY I START NOW?

☐ *Yes, permission is given* ⇨ *Go to UF12 to record the time and then begin the interview.*

☐ *No, permission is not given* ⇨ *Complete UF9. Discuss this result with your supervisor*

UF9. Result of interview for children under 5 Codes refer to mother/caretaker.	Completed ... 01 Not at home ... 02 Refused ... 03 Partly completed ... 04 Incapacitated ... 05 Other (*specify*)________ 96

AGE		
AG1. NOW I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT THE HEALTH OF (*name*). IN WHAT MONTH AND YEAR WAS (*name*) BORN? *Probe:* WHAT IS HIS / HER BIRTHDAY? If the mother/caretaker knows the exact birth date, also enter the day; otherwise, circle 98 for day Month and year must be recorded.	Date of birth Day ... __ __ DK day ... 98 Month ... __ __ Year ... __ __ __ __	
AG2. HOW OLD IS (*name*)? *Probe*: HOW OLD WAS (*name*) AT HIS / HER LAST BIRTHDAY? Record age in completed years. Record '0' if less than 1 year. Compare and correct AG1 and/or AG2 if inconsistent.	Age (in completed years)... __	

IMMUNIZATION

If an immunization card is available, copy the dates in IM3 for each type of immunization recorded on the card. IM6-IM17 are for registering vaccinations that are not recorded on the card. IM6-IM17 will only be asked when a card is not available.

IM1. DO YOU HAVE A CARD WHERE (*name*)'S VACCINATIONS ARE WRITTEN DOWN? (*If yes*) MAY I SEE IT PLEASE?	Yes, seen ... 1 Yes, not seen ... 2 No card ... 3	1⇨IM3 2⇨IM6
IM2. DID YOU EVER HAVE A VACCINATION CARD FOR (*name*)?	Yes ... 1 No ... 2	1⇨IM6 2⇨IM6

IM3.
(a) Copy dates for each vaccination from the card.
(b) Write '44' in day column if card shows that vaccination was given but no date recorded.

		Date of Immunization							
		Day		Month		Year			
BCG	BCG								
POLIO AT BIRTH	OPV0								
POLIO 1	OPV1								
POLIO 2	OPV2								
POLIO 3	OPV3								
DPT1	DPT1								
DPT2	DPT2								
DPT3	DPT3								
HEPB AT BIRTH	H0								
HEPB1	H1								
HEPB2	H2								
HEPB3	H3								
MEASLES (OR MMR)	MEASLES								

IM4. *Check IM3. Are all vaccines (BCG to Yellow Fever) recorded?*

☐ *Yes* ⇨ *Go to IM18*

☐ *No* ⇨ *Continue with IM5*

IM5. In addition to what is recorded on this card, did (*name*) receive any other vaccinations – including vaccinations received in campaigns or immunization days? Record 'Yes' only if respondent mentions vaccines shown in the table above.	Yes .... 1 (Probe for vaccinations and write '66' in the corresponding day column for each vaccine mentioned. Then skip to IM18) No .... 2 DK 8	2⇨IM18 8⇨IM18
IM6. Has (*name*) ever received any vaccinations to prevent him/her from getting diseases, including vaccinations received in a campaign or immunization day?	Yes .... 1 No .... 2 DK 8	2⇨IM18 8⇨IM18
IM7. Has (*name*) ever received a BCG vaccination against tuberculosis – that is, an injection in the arm or shoulder that usually causes a scar?	Yes .... 1 No .... 2 DK 8	
IM8. Has (*name*) ever received any "vaccination drops in the mouth" to protect him/her from getting diseases – that is, polio?	Yes .... 1 No .... 2 DK 8	2⇨IM11 8⇨IM11
IM9. Was the first polio vaccine received in the first two weeks after birth or later?	First two weeks .... 1 Later 2	
IM10. How many times was the polio vaccine received?	Number of times .... __	
IM11. Has (*name*) ever received a DPT vaccination – that is, an injection in the thigh or buttocks – to prevent him/her from getting tetanus, whooping cough, or diphtheria? *Probe by indicating that DPT vaccination is sometimes given at the same time as Polio*	Yes .... 1 No .... 2 DK 8	2⇨IM13 8⇨IM13
IM12. How many times was a DPT vaccine received?	Number of times .... __	
IM13. Has (*name*) ever been given a Hepatitis B vaccination – that is, an injection in the thigh or buttocks – to prevent him/her from getting Hepatitis B? *Probe by indicating that the Hepatitis B vaccine is sometimes given at the same time as Polio and DPT vaccines*	Yes .... 1 No .... 2 DK 8	2⇨IM16 8⇨IM16
IM14. Was the first Hepatitis B vaccine received within 24 hours after birth, or later?	Within 24 hours .... 1 Later 2	
IM15. How many times was a hepatitis B vaccine received?	Number of times .... __	

IM16. HAS (*name*) EVER RECEIVED A MEASLES INJECTION OR AN MMR INJECTION – THAT IS, A SHOT IN THE ARM AT THE AGE OF 9 MONTHS OR OLDER - TO PREVENT HIM/HER FROM GETTING MEASLES?	Yes .... 1 No .... 2 DK 8	

CHAPTER V. Expansion of health care facilities in Iraq a decade after the US-led invasion [12]

5.1 Introduction

Health care systems suffer a heavy toll in fragile and war affected states (Pedersen 2009). Iraq is an exemplifying case. Throughout the 1970s and 1980s, Iraq's health care system used to be one of the most advanced in the Middle East (Alwan 2004). The system was highly centralised, hospital-oriented and fully government-subsided with revenues from the nationalised oil industry (WHO 2006). However, in the last few decades the country's health care capacity has been severely undermined by the effects of different wars, international sanctions, sectarian violence and political instability.

Since the 1980–1988 Iran-Iraq War, resources were progressively diverted from the health sector (Alwan 2004). During the 1990–1991 Gulf War and the following 13 years of embargo and economic sanctions, public health budget was cut by 90 per cent and buildings and equipment fell into disrepair (Alwan 2004). At the time of the 2003 US-led invasion, serious damages occurred from widespread looting and destruction of facilities (Kapp 2003). The violence-induced exodus of thousands of doctors and nurses in the subsequent years further weakened the health care system (Zarocostas 2007).

The urgency of health care rehabilitation was clear in the aftermath of the invasion. After 2003, Iraq's Ministry of Health has set plans to expand health care service delivery, moving towards a decentralised primary health care model (Iraq Ministry of Health 2008). National development plans have also called for the emergence of a private sector, which

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may potentially contribute to enhance the provision of secondary and tertiary care (Iraq Ministry of Planning 2010). The separate Ministry of Health of the autonomous Iraqi Kurdistan region has shared a similar approach, namely a reorientation of the public sector towards primary health care and a larger role to the private sector for hospital care (Moore et al. 2014).

The shortcomings of the post-2003 health policy framework have been discussed extensively, in particular its lack of specificity and commitment to clear long-term objectives (The Lancet 2013; Lane and Al Hilfi 2013). Nevertheless, quantitative assessments of the policy outcomes have remained scant. This paper addresses this gap focusing on a key outcome indicator that is the expansion in number, type and location of health care facilities per population. The study intends to contribute to the growing body of academic and policy literature on health care system recovery in war-torn settings.

Strengthening health infrastructure is deemed a critical component for health care system recovery in Iraq as elsewhere (Waters, Garrett and Burnham 2007). Virtually all health strategies in countries emerging from war include plans for an adequate network of equitably distributed health care facilities to meet the population's health needs (Shuey et al. 2003; Rodriguez et al. 2014; Tulloch et al. 2003; Cometto, Fritsche and Sondorp 2010; Waldman and Hanif 2002). Studies have shown that successful infrastructure programmes, such as the expansion of health care facilities in underserved areas, increase access to services and may also foster the process of peace building and state legitimacy (Jones and Howarth 2012; Kruk et al. 2010; MacQueen and Santa Barbara 2000; Jones 2006).

However, this is an arduous and complex undertaking (Al Hilfi, Lafta and Burnham 2013). Previous research has stressed the importance of inclusive political settlements to bring the stability required to allow a successful implementation of any reconstruction and development plans (Furber and Johnson 2004; Webster 2011). Such stability has clearly lacked in post-2003 Iraq, characterised by fragile institutions and persistent sectarian strife (Bank 2011; Levy and Sidel 2013). The situation has been different in the autonomous Kurdistan region. Unlike the rest of the country, this region has not suffered from generalised violence and political uncertainty, and this has guaranteed more favourable conditions for development (The Lancet 2013).

These differences in political context within the country make Iraq a useful case study to assess variation in health policy outcomes. The following analysis compares changes in the number of health care facilities per population in the autonomous Kurdistan region, which has been relatively stable from 2003 onwards, and in the rest of Iraq, where persistent insecurity has posed major challenges to health care system recovery. The focus is on the expansion of primary health care centres, public hospitals and private hospitals a decade after the US-led invasion. We discuss the insights gained from such comparison and suggest policy implications for the coming years.

5.2 Iraq's health care system

The organisational structure of the Iraqi health care system dates back to 1970s and consists of two main levels: the Ministry of Health as a central planning level, and the Directorates of Health as a local administrative level in each governorate (WHO 2006). After the Gulf War, the three northern Kurdish governorates of Dohouk, Erbil and Al-Sulaimaniya became a de facto autonomous region under UN auspices, and a separate Ministry of Health was established for the Kurdistan Regional Government with much the same structure (Tawfik Shukor and Khoshnaw 2010).

In the public sector, health care services are provided through a network of primary health care centres and public hospitals at very low charges. The primary health care centres provide preventive and basic curative services. The main centres are located in urban areas and are typically administered by doctors, while smaller centres are located in rural areas and are generally staffed with medical auxiliaries only (Godichet and Ghanem 2004). Recent surveys have highlighted significant impediments to delivering adequate services in the primary health care centres, including poor organisation and shortage of manpower and medications (Shabila et al. 2012a; 2012b). Despite numerous problems, the primary health care centres are recognised as very important sources of health care provision, particularly for the poor (Burnham et al. 2011).

For secondary and tertiary care, patients are referred from primary health care centres to hospitals. However, it is estimated that only about 40 per cent of Iraqis have access to referral services due to the inadequate number and uneven distribution of public hospitals (Iraq Ministry of Health 2012). Secondary and tertiary care are also provided by small private hospitals. Since there are no health insurance schemes in Iraq, private health care is met out-of-pocket and is well beyond the reach of many Iraqis (Al Hilfi, Lafta and Burnham 2013). Moreover, although private hospitals are licensed by the Ministry of Health, they are still largely outside the national health supervision system (Iraq Ministry of Health and WHO EMRO 2009).

5.3 Methods

This study is based on data on health care facilities provided by the WHO and Iraq's Ministry of Health for the years 2003 and 2012 respectively. In early 2003, the WHO published a detailed record of all functioning health care facilities for each Iraqi governorate by type. The inventory and categorisation of facilities was carried out by the WHO staff a few months before the US-led invasion and was part of a broad attempt to evaluate the country's health care status (WHO 2003). Comparable data on the number and types of functioning health care facilities were extracted from the 2012 Annual Report of Iraq's Ministry of Health. This is the latest report available and is mainly a compilation of institutional and administrative records received from the Directorates of Health (Iraq Ministry of Health 2013).

We did not find any discrepancy in the classification of facilities between the two sources that might affect the comparison. The 2003 WHO data were very detailed, including facility name and district code. The 2012 Ministry of Health report did not provide such level of details. To ascertain data quality, we crosschecked information with other reports from previous years and we did not detect any inconsistencies.

The population of each governorate for the year 2003 and 2012 was also obtained from the WHO and Ministry of Health reports. Since no census has been conducted in Iraq after 1997, population data for both years rely on government estimates (see annex).

We used these data to quantify progress and setbacks in expanding health care service delivery infrastructure. Firstly, we calculated the change in the absolute number of health care facilities from early 2003 to the end of 2012. To account for population growth, we computed the change in the number of facilities per 100,000 population. We compared the prevalence of each type of facilities in the autonomous northern Kurdistan region and in the rest of Iraq (centre/south), and among the different governorates. We analysed trends in light of the national plans of reorienting the public health system towards primary health care and attributing a larger role to the private sector for hospital care.

The types of health care facilities included in the analysis are: primary health care centres (both large and small), public hospitals (all general hospitals at city, district and sub-district levels –if existing– and all specialty hospitals like paediatric, maternity, emergency, surgical, psychiatric and cardiology hospitals), and private hospitals (both secondary and tertiary). Since complete information about types of health services and personnel at each facility and number of beds at each hospital was not available, these important aspects could not be addressed in this paper.

5.4 Results

Table 5.1 shows changes in the number of primary health care centres between 2003 and 2012. In 2003, there was an average of 5.5 primary health care centres per 100,000 population, 2.7 small centres administered by medical auxiliaries and 2.8 large centres administered by doctors. These facilities were unevenly distributed across the country, ranging from 1.9 per 100,000 population in Baghdad to 21.6 in Al-Sulaimaniya. On average, the Kurdistan region exhibited a higher number of primary health care centres per 100,000 population than the rest of Iraq.

After a decade, the absolute number of primary health care centres increased in all governorates although not everywhere at the same pace. Improvements in the absolute number of facilities were partially, and in a few cases totally, offset by the high rate of population growth. On average, there were 7.4 primary health care centres per 100,000 population in 2012, about half of which were large centres administered by doctors. Although the rate of population growth was approximately the same in Kurdistan and central/southern Iraq, the gap in the number of primary health care centres per 100,000 population widened from 2003 to 2012, with an average increase of 4.3 primary health care centres per 100,000 population in Kurdistan versus an average increase of only 1.4 primary health care centres per 100,000 population in centre/south. Differences across governorates also persisted. In 2012, the number of small primary health care centres ranged from 0.1 to 5.9 per 100,000 population in the central/southern governorates and from 6.7 to 20.2 in the

Kurdish governorates. The number of large centres ranged from 2.6 to 4.3 in the central/southern governorates and from 5.4 to 6.8 in the Kurdish governorates.

Changes in the number of public and private hospitals are reported in Table 5.2. In 2003, there was an average of 0.7 public hospitals per 100,000 population. Differences across governorates were less pronounced than for primary health care centres. The number of public hospitals ranged from 0.4 per 100,000 population in Thi-Qar to 1.8 in Al-Sulaimaniya. On average, the number of public hospitals per 100,000 population was higher in the Kurdistan region than in the rest of Iraq.

In 2012, the countrywide average number of public hospitals per 100,000 population was still 0.7. However, the distribution of hospitals across governorates changed significantly. In most central/southern governorates, the limited improvements in the absolute number of public hospitals were completely offset by population growth. As a result, the average number of public hospitals per 100,000 population in centre/south was 0.6 in 2012 as in 2003. By contrast, the Kurdistan region experienced some progress, with the average number of public hospitals per 100,000 population rising from 1.3 to 1.5. At the governorate level, the number of public hospitals in 2012 ranged from 0.4 to 0.8 per 100,000 population in the central/southern governorates and from 1.1 to 1.7 in the Kurdish governorates.

Private hospitals in 2003 were very few and mostly concentrated in Baghdad, where the number per 100,000 population was 0.6. In the other governorates, the number of private hospitals per 100,000 population ranged from 0.0 in Kerbala, Al-Muthanna, Salah Al-Deen and Al-Najaf to 0.3 in Erbil. At that time, the average number of private hospitals per 100,000 population was relatively similar in Kurdistan and centre/south.

Over the period 2003–2012, the number of private hospitals exhibited diverging trends in Kurdistan and central/southern Iraq. In centre/south, the number of private hospitals per

100,000 population declined from 0.3 to 0.2. Some central/southern governorates, including Baghdad, experienced a reduction even in the absolute number of these hospitals. By contrast, in Kurdistan the number of private hospitals per 100,000 population rose from 0.2 to 0.6.

5.5 Discussion

This study has been the first to analyse the expansion of health care facilities in post-2003 Iraq. The analysis has revealed some progress, but also many persistent challenges. Over 1,000 new primary health care centres and 46 public hospitals were functioning in 2012 compared with 2003. The relatively larger amount of investments in primary health care centres than in public hospitals is consistent with the Ministry of Health plan of reorienting the public health sector towards primary care (Iraq Ministry of Health 2010; Moore et al. 2014). Still in 2012 there was a countrywide average of only 7.4 primary health care centres per 100,000 population compared with over 20 primary health care centres per 100,000 population in neighbouring Jordan and Iran (Library of Congress Federal Research Division 2006; 2008). Efforts to expand the provision of health care services were hindered by the high rate of population growth, averaging 2.6 per cent per annum. Due to population growth, the countrywide average number of public hospitals per 100,000 population in 2012 was still 0.7 as in 2003.

There were significant differences in the extent of improvement within the country. In particular, the gap in the average number of primary health care centres and public hospitals per 100,000 population between the autonomous Kurdistan region and the rest of Iraq widened. The relatively better status of health infrastructure in Kurdistan originated in the post-1991 period and especially in the years of the Oil-for-Food Programme between

1996 and 2003. This programme was approved by the UN Security Council after five years of strict international sanctions and allowed Iraq to use revenues of oil sales for humanitarian needs (United Nations Office of the Iraqi Oil-for-Food Programme 2003a). The programme was managed directly by UN agencies in Kurdistan and by the Iraqi government in the rest of the country. During this period, new health care facilities, particularly primary health care centres, were built in Kurdistan by UNICEF and UN-Habitat (United Nations Office of the Iraqi Oil-for-Food Programme 2003b), whereas government investments in health infrastructure in central/southern Iraq were very limited (Alwan 2004).

After 2003, central/southern Iraq has been affected by widespread insurgent and sectarian violence. Security concerns had dramatic consequences on budget allocation and feasibility of health infrastructure projects. For example, almost 50 per cent of Baghdad governorate budget during the years of the occupation was devoted to security, with the health sector receiving only 1 per cent of governorate funds (Webster 2009). Since most existing health care facilities in centre/south had fallen into disrepair during the sanctions and had suffered further damages following the 2003 invasion, a substantial proportion of total health expenditure had to be used for repairs and renovations (Wilson 2004). By contrast, the Kurdistan region has remained relatively safe from 2003 onwards. Since there was no fighting in the region, funds from coalition forces were invested mainly in humanitarian fields, including construction of new health care facilities (Kurdistan Regional Government of Iraq 2010). The more secure and stable situation has also allowed the Kurdistan Regional Government to achieve a higher health expenditure than the Central Government of Baghdad (Webster 2009).

The widening gap in health infrastructure between the Kurdistan region and the rest of Iraq is also related to the expansion of the private sector as 23 new private hospitals were opened in Kurdistan. Since 2007, the Kurdistan Regional Government has adopted a flexible investment policy which has attracted an increasing number of local and foreign investors in a variety of sectors, including health care (Kurdistan Regional Government of Iraq 2014). The Ministry of Health of Baghdad has also recognised that the private sector has a potentially important role in improving health service provision (Iraq Ministry of Planning 2010). However, insecurity and political instability continue to discourage private investments in central/southern Iraq, and the violence-induced outmigration of doctors has led to the closure of a few private hospitals operating during the pre-2003 period (Moore et al. 2014).

This study adds to the limited documented knowledge about the expansion of health care facilities in countries emerging from war. It provides an insight into the adverse effect of continuing insecurity and instability on health care system recovery, and confirms the importance of inclusive political settlements in enabling successful reconstruction and development plans. The relevance of this paper goes beyond the specific context of Iraq and it can serve as a case study for similar countries where strengthening health infrastructure is a main challenge. A slow pace of reconstruction process due to an uncertain political context has also been noted in other countries emerging from war (see Cometto, Fritsche and Sondorp 2010 for South Sudan; Sondorp and Coolen 2012 for Liberia; Bertone et al. 2014 for Sierra Leone). In the case of Iraq, the comparison between Kurdistan and centre/south makes this particularly evident. While other countries have gradually overcome the political uncertainty and consolidated their institutions, the political situation of central/southern Iraq a decade after the US-led invasion has remained insecure and fragmented. In fact, the recent wave of violence has further undermined state legitimacy and led to the complete disintegration of health services in the areas controlled by Islamist rebels (Webster 2014).

Due to persistent and growing insecurity, it is unlikely that significant private investments in the health sector will occur in the short-term. This highlights the need for the new Iraqi government, together with international donors, to urgently scale-up resources and commit to strengthening the network of health care facilities in underserved areas. Promoting political inclusiveness, transparency in decision-making and accountability in public financial management should be priorities, at both the central and governorate levels, to accelerate progress in the coming years.

Finally, the expansion of facilities is necessary but not sufficient to ensure the right to health care for all Iraqis. The data used in this study did not permit to address important issues concerning quality of care and equitable access to services. While we assessed changes in the number of health care facilities, we could not take into account changes in the size, personnel and types of services provided in these facilities or their distribution between urban and rural areas and between wealthier and poorer districts. Moreover, we could not evaluate the effect that the rapid expansion of a largely unregulated private sector in the Kurdistan region had in terms of high-quality health care provision, and the risks that privatisation may pose in terms of affordability of care and related health inequities. Further research is needed to measure the performance and accessibility of public and private health care facilities.

Table 5.1 *Number of primary health care centres (PHCCs) in Iraq by governorate and region in 2003 and 2012*

Governorates	Small PHCCs per 100,000 population (number)		Large PHCCs per 100,000 population (number)		Total PHCCs per 100,000 population (number)		Change in PPHCs per 100,000 population (number)
	2003	2012	2003	2012	2003	2012	2003–2012
Baghdad	0.1 (5)	0.1 (9)	1.8 (119)	2.9 (207)	1.9 (124)	3.0 (216)	+1.1 (+92)
Basrah	0.4 (8)	0.3 (8)	3.1 (62)	4.3 (113)	3.5 (70)	4.6 (121)	+1.1 (+51)
Nineveh	1.7 (44)	1.6 (54)	2.9 (73)	3.0 (102)	4.6 (117)	4.6 (156)	+0.0 (+39)
Maysan	1.3 (11)	5.1 (51)	2.1 (18)	2.9 (29)	3.4 (29)	8.0 (80)	+4.6 (+51)
Al-Dewaniya	2.3 (21)	2.8 (33)	2.7 (25)	3.3 (38)	5.0 (46)	6.1 (71)	+1.1 (+25)
Diala	1.9 (24)	2.2 (32)	2.3 (29)	4.3 (64)	4.2 (53)	6.5 (96)	+2.3 (+43)
Al-Anbar	5.3 (67)	5.9 (95)	3.9 (50)	4.1 (66)	9.2 (117)	10.0 (161)	+0.8 (+44)
Babylon	2.6 (36)	3.2 (59)	2.3 (32)	2.8 (52)	4.9 (68)	6.0 (111)	+1.1 (+43)
Kerbala	0.5 (4)	2.1 (23)	2.7 (20)	2.6 (28)	3.2 (24)	4.7 (51)	+1.5 (+27)
Kirkuk	2.6 (23)	4.2 (60)	4.1 (36)	3.8 (54)	6.7 (59)	8.0 (114)	+1.3 (+55)
Wasit	0.6 (6)	1.7 (21)	2.7 (25)	3.4 (42)	3.3 (31)	5.1 (63)	+1.8 (+32)
Thi-Qar	1.9 (29)	3.7 (70)	2.1 (32)	3.6 (68)	4.0 (61)	7.3 (138)	+3.3 (+77)
Al-Muthanna	0.2 (1)	3.5 (26)	3.9 (22)	4.2 (31)	4.1 (23)	7.7 (57)	+3.6 (+34)
Salah Al-Deen	3.4 (33)	3.4 (49)	4.0 (39)	3.4 (49)	7.4 (72)	6.8 (98)	-0.6 (+26)
Al-Najaf	2.1 (20)	2.5 (33)	1.5 (14)	3.3 (43)	3.6 (34)	5.8 (76)	+2.2 (+42)
Centre/South	**1.4 (332)**	**2.1 (623)**	**2.6 (596)**	**3.3 (986)**	**4.0 (928)**	**5.4 (1,609)**	**+1.4 (+681)**
Erbil	6.4 (86)	10.9 (180)	4.6 (61)	5.4 (90)	11.0 (147)	16.3 (270)	+5.3 (+123)
Dohouk	3.9 (32)	6.7 (78)	5.9 (48)	6.8 (79)	9.8 (80)	13.5 (157)	+3.7 (+77)
Al-Sulaimaniya	17.7 (284)	20.2 (391)	3.9 (63)	5.7 (111)	21.6 (347)	25.9 (502)	+4.3 (+155)
Kurdistan	**10.7 (402)**	**13.7 (649)**	**4.6 (172)**	**5.9 (280)**	**15.3 (574)**	**19.6 (929)**	**+4.3 (+355)**
Total Iraq	**2.7 (734)**	**3.7 (1,272)**	**2.8 (768)**	**3.7 (1,266)**	**5.5 (1,502)**	**7.4 (2,538)**	**+1.9 (+1,036)**

Table 5.2 *Number of public and private hospitals in Iraq according by governorate and region in 2003 and 2012*

Governorates	Public hospitals per 100,000 population (number)		Change in public hospitals per 100,000 population (number)	Private hospitals per 100,000 population (number)		Change in private hospitals per 100,000 population (number)
	2003	**2012**	**2003-2012**	**2003**	**2012**	**2003-2012**
Baghdad	0.6 (38)	0.6 (46)	+0.0 (+8)	0.6 (41)	0.5 (36)	-0.1 (-5)
Basrah	0.5 (10)	0.5 (13)	+0.0 (+3)	0.2 (4)	0.2 (4)	+0.0 (+0)
Nineveh	0.5 (13)	0.4 (14)	-0.1 (+1)	0.2 (4)	0.1 (3)	-0.1 (-1)
Maysan	0.8 (7)	0.6 (6)	-0.2 (-1)	0.1 (1)	0.0 (0)	-0.1 (-1)
Al-Dewaniya	0.8 (7)	0.5 (6)	-0.3 (-1)	0.2 (2)	0.3 (3)	+0.1 (+1)
Diala	0.6 (8)	0.7 (10)	+0.1 (+2)	0.2 (2)	0.2 (3)	+0.0 (+1)
Al-Anbar	0.9 (11)	0.7 (11)	-0.2 (+0)	0.1 (1)	0.1 (2)	+0.0 (+1)
Babylon	0.6 (8)	0.8 (15)	+0.2 (+7)	0.1 (2)	0.2 (4)	+0.1 (+2)
Kerbala	0.7 (5)	0.5 (5)	-0.2 (+0)	0.0 (0)	0.2 (2)	+0.2 (+2)
Kirkuk	0.7 (6)	0.5 (7)	-0.2 (+1)	0.2 (2)	0.1 (2)	-0.1 (+0)
Wasit	1.0 (9)	0.6 (8)	-0.4 (-1)	0.1 (1)	0.0 (0)	-0.1 (-1)
Thi-Qar	0.4 (6)	0.5 (9)	+0.1 (+3)	0.1 (1)	0.1 (2)	+0.0 (+1)
Al-Muthanna	0.7 (4)	0.5 (4)	-0.2 (+0)	0.0 (0)	0.0 (0)	+0.0 (+0)
Salah Al-Deen	0.7 (7)	0.6 (9)	-0.1 (+2)	0.0 (0)	0.1 (2)	+0.1 (+2)
Al-Najaf	0.6 (6)	0.5 (7)	-0.1 (+1)	0.0 (0)	0.2 (3)	+0.2 (+3)
Centre/South	**0.6 (145)**	**0.6 (170)**	**+0.0 (+25)**	**0.3 (61)**	**0.2 (66)**	**-0.1 (+5)**
Erbil	0.9 (12)	1.4 (23)	+0.5 (+11)	0.3 (4)	0.8 (13)	+0.5 (+9)
Dohouk	0.9 (7)	1.1 (13)	+0.2 (+6)	0.1 (1)	0.3 (3)	+0.2 (+2)
Al-Sulaimaniya	1.8 (29)	1.7 (33)	-0.1 (+4)	0.1 (2)	0.7 (14)	+0.6 (+12)
Kurdistan	**1.3 (48)**	**1.5 (69)**	**+0.2 (+21)**	**0.2 (7)**	**0.6 (30)**	**+0.4 (+23)**
Total Iraq	**0.7 (193)**	**0.7 (239)**	**+0.0 (+46)**	**0.3 (68)**	**0.3 (96)**	**+0.0 (+28)**

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5.7 Annex

Table A5.1 *Estimated population of Iraq by governorate and region in 2003 and 2012*

Governorates	Population (thousand)		Annual growth rate (per cent)
	2003	2012	2003-2012
Baghdad	6,500	7,255	+1.2
Basrah	1,982	2,602	+3.1
Nineveh	2,521	3,354	+3.3
Maysan	848	997	+1.8
Al-Dewaniya	916	1,162	+2.7
Diala	1,271	1,478	+1.6
Al-Anbar	1,271	1,599	+2.6
Babylon	1,409	1,864	+3.2
Kerbala	742	1,094	+4.7
Kirkuk	881	1,433	+6.3
Wasit	939	1,241	+3.2
Thi-Qar	1,539	1,883	+2.2
Al-Muthanna	570	736	+2.9
Salah Al-Deen	976	1,441	+4.8
Al-Najaf	950	1,320	+3.9
Centre/South	**23,315**	**29,459**	**+2.6**
Erbil	1,334	1,658	+2.4
Dohouk	817	1,159	+4.2
Al-Sulaimaniya	1,606	1,932	+2.0
Kurdistan	**3,757**	**4,749**	**+2.6**
Total Iraq	**27,072**	**34,208**	**+2.6**

CHAPTER VI. Conclusion

6.1 Findings of this thesis and their implications

This thesis was motivated by the paucity of research on the demographic and health effects of war other than mortality (Brunborg and Tabeau 2005; Brunborg and Urdal 2005; Burkle 2006; Thoms and Ron 2007; Guha Sapir and D'Aoust 2010; Rezaeian 2015). The analysis has focused on one of the most controversial and internationally debated wars in recent decades, that is the 2003–2011 war in Iraq (Cottey 2004). I have shown that, besides causing a heavy death toll, this war also had profound long-term consequences on fertility and population health. In this final chapter, I summarise the overall findings of the thesis and discuss their implications, alongside limitations and recommendations for future research.

Summary of findings

The starting point for this thesis was a review of the current status of knowledge and knowledge gaps. The increasing international concern about the consequences of warfare for civilian populations has led to a growing body of demographic and health research. This research has been essential in providing estimates of war-induced excess mortality. Far less attention has been paid to war-induced changes in fertility and population health, and the limited existing literature has rarely adopted a longitudinal approach (Guha Sapir and D'Aoust 2010). This is especially evident in the case of the 2003–2011 war in Iraq. Several studies have sought to quantify excess mortality using data from retrospective household surveys (Roberts et al. 2004, UNDP 2005; Burnham et al. 2006, Opinion

Research Business 2007; Alkhuzai et al. 2008, Hagopian et al. 2013), whereas other demographic and health consequences of this war have been largely overlooked.

Monitoring demographic and health indicators during wartime is essential to inform the international community and target humanitarian relief interventions (Checchi and Roberts 2008). However, the feasibility of carrying out representative household surveys in war zones has been the subject of considerable debate (Barakat et al. 2002; Thoms and Ron 2007; Haer and Becher 2012; Spagat 2012). This is because the contextual dimensions of war that make up-to-date demographic and health data so essential also make the design and implementation of representative household surveys more challenging (Mneimneh et al. 2014).

Surprisingly, the debate around the potential undermining effect of war on survey representativeness had lacked any assessment of leading survey programmes, such as the UNICEF Multiple Indicator Cluster Surveys. Iraq is one of the few countries were two Multiple Indicator Cluster Surveys were conducted during war, in 2006 and 2011. These surveys aimed to provide information on the situation of Iraqi women and children and allow for a comparison with pre-war indicators that had been collected by a similar survey in 2000. The surveys covered the whole country, including the autonomous northern Kurdistan region, which remained relatively safe during the war, and central/southern Iraq, where violence and disruption were pervasive (Iraq Council of Ministers, Planning Commission and Central Statistical Organisation 2001; Iraq Central Organisation for Statistics and Information Technology and Kurdistan Regional Statistics Office 2007; 2013).

In chapter II, I compared the prevalence of some errors that may compromise household survey representativeness, namely coverage imprecision, non-response and measurement errors, contrasting the situations before and during war and also distinguishing between war-affected and not affected regions. I found no evidence that the extent of these errors was exacerbated during war. List frame imprecision was negligible across the three survey in central/southern Iraq as well as in Kurdistan. Household participation to the surveys was almost universal and there was no sign of increased intentional or unintentional exclusion of eligible respondents during war.

In chapter III, I used retrospective birth history data from these surveys to provide a detailed account of fertility trends in Iraq, with a special focus on the changes resulting from the 2003–2011 war and the factors underlying them. Fertility trends during this war, as well as during the preceding period, had remained largely undocumented (Tabutin and Schoumaker 2005; Casterline 2009). I found that total fertility declined steeply in the autonomous Kurdistan region, from an average of 5 children per women in the late 1990s to 3 children per woman in 2010. By contrast, in war-torn central/southern Iraq total fertility remained stable at about 4.5 children per woman. Using decomposition techniques, I showed that this apparent stability was the result of two countervailing trends in age at marriage and marital fertility.

The decline in marital fertility, which was already underway before 2003, accelerated during the war. However, the post-2003 period has witnessed an abrupt shift in the timing of births towards younger ages. Adolescent fertility in particular increased by over 30 per cent after the onset of the war. This was the result of an increased prevalence of early marriage among less-educated women. This trend is worrisome because women who marry during adolescence tend to have lower status in the home, and adolescents who bear children face higher risks of maternal mortality and morbidity as well as poorer health outcomes for their children (Jenson and Thornton 2003; Mathur et al. 2003; UNICEF 2005; Save the Children 2013).

In chapter IV, I used retrospective vaccination history data to assess the impact of the 2003–2011 war on neonatal polio immunisation coverage. The consequences of this war on the provision of basic health services, such as immunisation, had remained largely unquantified (The Lancet 2013). I found that, after dropping dramatically in the aftermath of the Gulf War, neonatal polio immunisation coverage was recovering during the early 2000s in central/southern Iraq as well as in the autonomous Kurdistan region. In Kurdistan, the status of health services continued to improve in the post-2003 period and neonatal polio immunisation coverage increased considerably. By contrast, in central/southern Iraq coverage declined again during the recent war. Using difference-in-difference regressions, I demonstrated that children exposed to the war were over 20 percentage points less likely to receive neonatal polio immunisation compared with non-exposed children.

The decline in neonatal polio immunisation coverage in central/southern Iraq is part of a broader war-induced deterioration in the country's health care capacity. My findings confirms anecdotal reports documenting that since 2003 pervasive violence and disruption have restricted access to health care facilities and, at the same time, reduced the quality of services provided in such facilities (Al Hilfi et al. 2013; Webster 2013; Fernandez and Boulle 2013). The war-induced decline in polio immunisation coverage has resulted in the re-emergence of the disease in 2014, after a nearly 15-year absence (Arie 2014). Due to the ongoing insecurity, the recent polio outbreak in Iraq and neighbouring Syria is one of the most challenging in the history of polio eradication (Jones 2014).

In chapter V, I and Dr. Nazar P. Shabila provided further insights into the adverse effect of ongoing insecurity on the health care sector. Quantitative assessments of the post-2003 efforts to expand health care infrastructure had remained scant (The Lancet 2013; Lane and Al Hilfi 2013). We found that the countrywide number of primary health care centres per 100,000 population rose from 5.5 in 2003 to 7.4 in 2012. However, the extent of improvement varied significantly within the country, with an average increase of 4.3 primary health care centres per 100,000 population in Kurdistan versus an average increase of only 1.4 in central/southern Iraq. The average number of public hospitals per 100,000 population rose from 1.3 to 1.5 in Kurdistan, whereas it remained at 0.6 in centre/south. The average number of private hospitals per 100,000 population rose from 0.2 to 0.6 in Kurdistan, whereas it declined from 0.3 to 0.2 in centre/south.

Security concerns in central/southern Iraq had dramatic consequences on budget allocation and feasibility of health infrastructure projects (Webster 2009). The limited improvements in the number of primary health care centres and public hospitals have been largely or totally offset by the high rate of population growth, averaging 2.6 per cent per annum. Insecurity and political instability have also discouraged private investments, and the violence-induced outmigration of doctors has led to the closure of a few private hospitals operating during the pre-2003 period (Moore et al. 2014). Due to persistent and growing insecurity, the expansion of health care infrastructure will remain an arduous undertaking in the coming years.

Implications

These findings have important documentation functions for the international community and serve as inputs for the design of humanitarian relief strategies in Iraq and similar war-torn countries, such as neighbouring Syria.

In most wars, demographic and health indicators other than mortality have been missing or deficient (Guha Sapir and D'Aoust 2010). My assessment of the Iraq Multiple Indicator Cluster Surveys has shown that carrying out representative surveys in war settings is feasible, if rigorous sampling and fieldwork procedures are followed. Longitudinal data, like those used in this thesis to reconstruct fertility and immunisation trends, should be collected systematically through consecutive replications of retrospective household surveys and should be made available for analysis in a timely manner.

A number of demographers, epidemiologists, publish health practitioners and human rights activists have called for the establishment of a technical, independent body dedicated to the collection of mortality data in war settings. Such a body could promote best practice methods and train a cadre of researchers to be deployed to war-torn countries. It is widely recognised that this would constitute a valuable resource for humanitarian agencies and would improve the quality of media coverage and international discussion around ongoing wars (Spiegel 2007; Checchi and Roberts 2008; Tapp et al. 2008). Given the findings of this thesis, I argue that the role of such a body should be extended to the collection of other demographic and health data in order to provide a more comprehensive account of the consequences of war on civilian populations.

My analysis of fertility trends in Iraq has shown that war can dramatically affect the status and reproductive health of adolescent girls. Although the Millennium Declaration signalled global recognition that empowering women matters in its own right and as a prerequisite for the health and development of families and societies, the specific needs and circumstances of adolescent girls were overlooked in the Millennium Development Goals. The Post-2015 Development Agenda recognises early marriage as a serious human rights violation and includes a specific target to end this harmful practice (OECD 2015; Girls Not Brides 2015).

Concerted efforts by local and international actors will be needed to reverse the increased prevalence of early marriage in Iraq. Anecdotal evidence suggests that a similar war-induced shift towards early marriage is also occurring in neighbouring Syria (Save the Children 2014). My study highlights the importance of providing opportunities for adolescent girls in war-torn settings, including formal and non-formal education, as well as taking measures to restore an overall sense of security in their daily lives. It also suggests that awareness raising campaigns about the risks of early marriage and childbearing should be part of the WHO Minimum Essential Package for Reproductive Health in Crisis Situations.

My analysis of neonatal polio immunisation coverage has shown the devastating consequences of the Iraq War on the provision of basic public health services. Over the last few decades, global progress towards polio eradication has been remarkable. The annual number of polio cases recorded worldwide has fallen by 99 per cent since the Global Polio Eradication Initiative was established in 1988 (Bhutta 2011; Maher 2013). Polio could be the second human disease after smallpox to be eradicated through vaccination, constituting a major global public health achievement (WHO 2014a).

The war-induced drop in polio immunisation coverage in Iraq and Syria has been a serious setback, resulting in the re-emergence of the disease in both countries after a nearly 15-year absence. In response to the outbreak, the WHO Eastern Mediterranean Region has declared a state of emergency, calling for support in negotiating and establishing access to those children who are unreached with polio vaccination because of insecurity (Mohammadi 2013; WHO 2014b). My findings confirm the need for increased humanitarian efforts to strengthen vaccination services and improve surveillance for polioviruses in war zones. More generally, the outbreak is a reminder that, until polio is completely eradicated, it is essential to maintain high immunisation coverage in countries where the disease is not currently circulating.

My study with Dr. Nazar P. Shabila has shown how persistent insecurity and political instability continue to hinder the expansion of health care infrastructure in Iraq. Public health needs, such as routine immunisation, can only be successfully met if an adequate network of equitably distributed health care facilities is in place. The Health Systems

Global Board has recently organised a Thematic Working Group on Health Systems in Fragile and Conflict-affected States to promote research informing responsive and context-specific health care rehabilitation and development efforts (Health System Global Board 2014).

I and Dr. Nazar P. Shabila conducted our assessment of number, type and location of health care facilities in Iraq as part of a thematic series launched by this Working Group (Fustukian, Roberts and Sondorp 2014). Our findings highlight the need for the Iraqi government and international donors to urgently scale-up resources and commit to strengthening the network of health care facilities in underserved areas by setting specific goals and clear deadlines for achieving them. To accelerate progress in the coming years, it is critical to promote political inclusiveness, transparency in decision-making and accountability in public financial management. These considerations will be equally relevant to rebuild the devastated health infrastructure in Syria.

6.2 Limitations and directions for future research

Notwithstanding its contributions to knowledge, this thesis has a number of limitations that should be addressed by future research and data collection.

The survey assessment in chapter II would have been significantly strengthened by more detailed information on the operational strategies that were used by cartographers, household listers, field supervisors and interview teams to achieve high coverage, response and accuracy despite the war. This information would have been valuable for the successful design and implementation of similar data collection efforts in other war settings. Future surveys should consider collecting metadata to document tailored design and field strategies that are likely to preserve survey representativeness during periods of generalised violence and instability.

The fertility decomposition analysis in chapter III could have been extended in several ways. If available, marital histories could have been used to shed light on the consequences of war on temporary spousal separation, divorce, widowhood, remarriage and polygamy. Contraceptive histories would have made it possible to monitor changes in family planning practices of women across time, including method switching, contraceptive discontinuation and related unintended pregnancies during war. To gain insights into these issues without survey overload, marital and contraceptive histories could be collected for the five years preceding the survey among a sub-sample of women only.

A more comprehensive overview of the public health effects of war could have been provided in chapter IV, if retrospective information on access to other basic health services besides immunisation was collected. Data on antenatal care and institutional delivery are particularly important and should be collected for all births occurring during the five years preceding the survey. Conducting separate surveys to assess access to health care among other population groups, such as the elderly and individuals suffering from non-communicable diseases, should also be considered depending on the epidemiological context and age structure of the war-affected population.

The assessment of health infrastructure development efforts in chapter V would have been much more informative if details on size, personnel and service types in each facility were recorded and made available by the Directorates of Health. Distribution of facilities between urban and rural areas and between wealthier and poorer districts would have been useful to evaluate equity in health infrastructure investments within governorates. More health services research is needed to measure the performance and accessibility of public and private health care facilities in war-zones.

A final, more general consideration concerns the methodological approach of this thesis. The overall impact of the 2003–2011 war was quantified by comparing demographic and health trends before and during war in central/southern Iraq, and using the safe northern Kurdistan region as a counterfactual. However, the multitude of contextual factors leading to demographic and health changes during war needs further investigation. With this respect, a promising venue for future research in Iraq and other war-torn settings would be to combine quantitative analysis with qualitative methods, such as focus groups with war-affected communities and key informant interviews with humanitarian actors.

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