The Republic of the Union of Myanmar

The 2014 Myanmar Population and Housing Census

THEMATIC REPORT ON MATERNAL MORTALITY

Census Report Volume 4-C

MYANMAR Census 2014

Department of Population
Ministry of Labour, Immigration and Population

With technical assistance from UNFPA

SEPTEMBER 2016

UNFPA

The 2014 Myanmar Population and Housing Census

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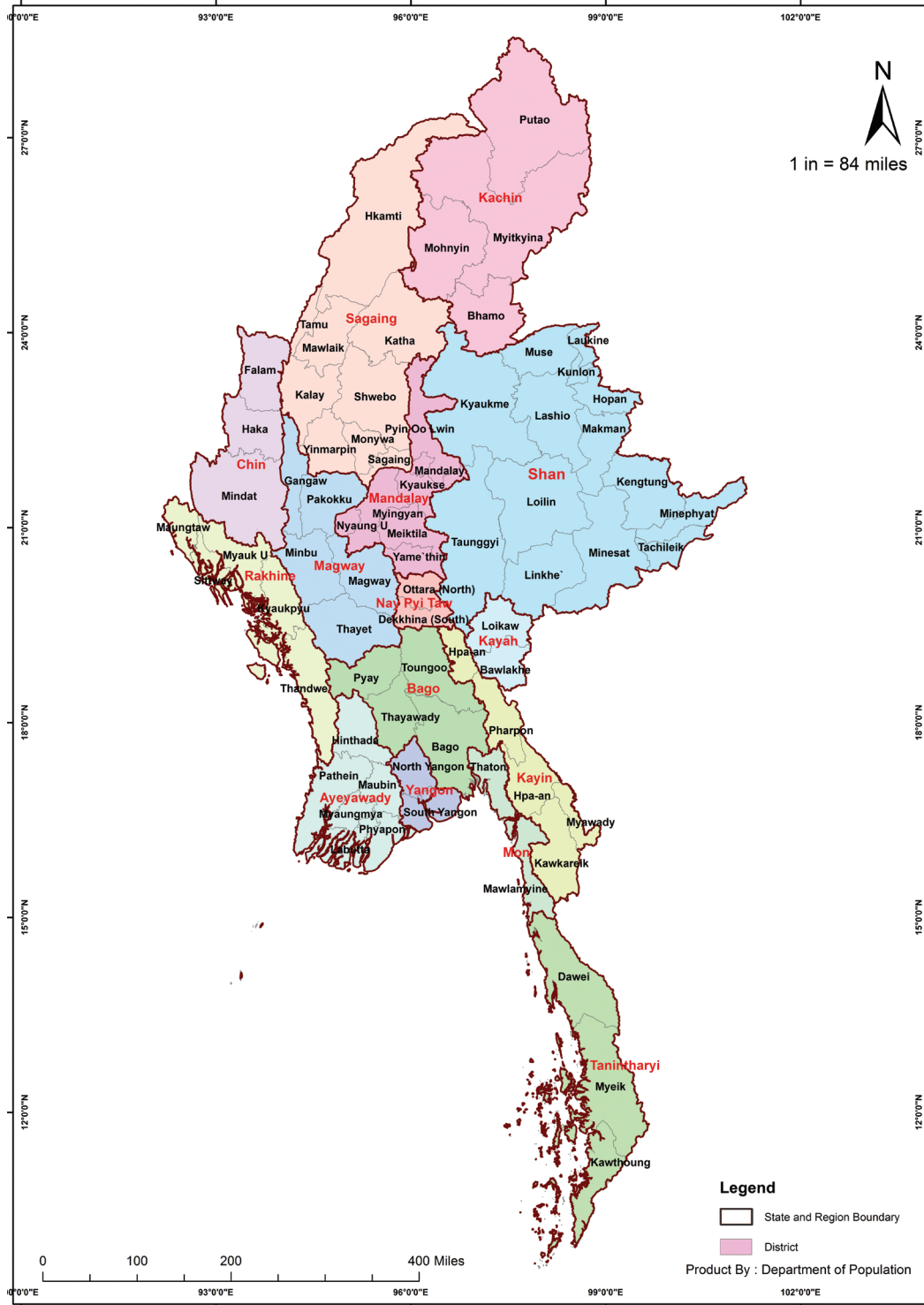Ministry of Labour, Immigration and Population**

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Figure 1

Map of Myanmar by State/Region and District

Foreword

The 2014 Myanmar Population and Housing Census (2014 Census) was conducted with midnight of 29th March 2014 as the reference point. This is the first Census in 30 years; the last was conducted in 1983. Planning and execution of this Census was spearheaded by the former Ministry of Immigration and Population, now the Ministry of Labour, Immigration and Population, on behalf of the Government, in accordance with the Population and Housing Census Law, 2013. The main objective of the 2014 Census was to provide the Government and other stakeholders with essential information on the population, in regard to demographic, social and economic characteristics, housing conditions and household amenities. By generating information at all administrative levels, it was also intended to provide a sound basis for evidence-based decision-making, and to evaluate the impact of social and economic policies and programmes in the country.

The results of the 2014 Census have been published to date in a number of volumes. The first was the *Provisional Results* (Census Report Volume 1), which was released in August 2014. The Census Main Results were launched in May 2015. These included *The Union Report* (Census Report Volume 2), *Highlights of the Main Results* (Census Report Volume 2-A), and the reports of each of the 15 States and Regions (Census Report Volume 3[A - O]). The reports on *Occupation and Industry* (Census Report Volume 2-B) and *Religion* (Census Report Volume 2-C) were launched in March 2016 and July 2016, respectively.

The current set of 2014 Census publications comprise thirteen thematic reports and a Census Atlas. They address issues on Fertility and Nuptiality; Mortality; Maternal Mortality; Migration and Urbanization; Population Projections; Population Dynamics; the Elderly; Children and Young People; Education; Labour Force; Disability; Gender Dimensions; and Housing Conditions, Amenities and Household Assets. Their preparation involved collaborative efforts with both local and international experts as well as various Government Ministries, Departments and research institutions.

Data capture was undertaken using scanning technology. The processes were highly integrated, with tight controls to guarantee accuracy of results. To achieve internal consistency and minimize errors, rigorous data editing and validation were carried out to facilitate further analysis of the results. The information presented in these reports is therefore based on more cleaned data sets, and the reader should be aware that there may be some small differences from the results published in the first set of volumes. In such instances, the data in the thematic reports should be preferred.

This thematic report presents the status of maternal mortality in Myanmar. The analysis shows that maternal mortality in the country is high at 282 deaths per 100,000 live births, and that there is a need for concerted efforts to ensure that women have access to services that provide high quality health care before, during and after childbirth. Furthermore, about 10 per cent of female deaths of women of reproductive age (15-49 years) are attributed to maternal deaths. By State and Region, maternal mortality ratios are very high in Chin, Ayeyawady and Magway, while they are lowest in Tanintharyi, Nay Pyi Taw and Yangon. Although steps are being taken to provide health services in these areas with high maternal mortality, there is also a need to carry out more specialized surveys to determine why mortality rates remain high in the country and in specific States and Regions.

Foreword

On behalf of the Government of Myanmar, I wish to thank the teams at the Department of Population, the United Nations Population Fund (UNFPA) and the authors for their contribution towards the preparation of this thematic report. I would also like to thank our development partners, namely; Australia, Finland, Germany, Italy, Norway, Sweden, Switzerland, and the United Kingdom for their support to undertake the census, as well as the technical support provided by the United States of America.

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Acronyms

AMDD	Averting Maternal Death and Disability Program
ASFR	Age-Specific Fertility Rate
BGBE	Brass Growth Balance Equation
GDP	Gross Domestic Product
GFR	General Fertility Rate
ICPD	International Conference on Population and Development
LTR	Lifetime Risk of Maternal Death
MDGs	Millennium Development Goals
MMRate	Maternal Mortality Rate
MMRatio	Maternal Mortality Ratio
PMFD	Proportion of Adult Female Deaths due to Maternal Causes
PPP	Purchasing Power Parity
SAB	Skilled Attendants at Birth
SDGs	Sustainable Development Goals
TFR	Total Fertility Rate
UN	United Nations
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNPD	United Nations Population Division
UNSD	United Nations Statistics Division
USAID	United States Agency for International Development
WB	World Bank
WHO	World Health Organization

Executive Summary

Over the past three decades high levels of maternal mortality in developing countries have been increasingly recognized as a pressing public health issue by governments, as well as in international forums and development agendas. Although levels have declined over the past two decades, maternal mortality levels are still comparatively high and more progress is needed. This is the case in most developing countries, including Myanmar.

The world's interest in maternal mortality has resulted in an increasing demand for estimates both at the national and subnational levels. However, in most developing countries maternal mortality data are either not available or are inadequate for providing accurate estimates. Population and housing censuses are increasingly being used for producing reasonably reliable estimates of maternal mortality, although it is still an enormous challenge.

The United Nations recommends that in countries with no, or poor, registration of deaths, censuses should include questions on deaths in a household during a reference period, such as twelve months before the enumeration of the population. The addition of this module allows for the inclusion of additional questions regarding maternal deaths among women of reproductive age.

The 2014 Myanmar Census provided the opportunity to measure maternal mortality. The questions on deaths in households during the twelve months prior to the Census were included in the questionnaire, as well as questions necessary to estimate maternal mortality indicators.

The questions to measure both adult mortality, as well as maternal mortality, follow international recommendations. It is important to clarify that maternal mortality questions, as in most censuses, identify pregnancy-related deaths, rather than true maternal deaths. Nevertheless, regardless of the definition used, in most countries the results are usually reported as maternal deaths, and this analysis refers to maternal mortality.

The data required for estimating maternal mortality from a census comes from the number of deaths that took place in a household during the twelve months prior to a census. However, data from this source often have errors, which can result in an under- or over-enumeration of deaths. Therefore, an initial step to estimate maternal mortality is to evaluate the completeness of the recorded number of female deaths.

The accompanying 2014 Census Thematic Report on Mortality discusses childhood and adult mortality. In that report a full evaluation was conducted on the completeness of deaths recorded in the Census from the question on the number of deaths in a household during the twelve months prior to the enumeration. There are several methods available for such an evaluation. The method used to evaluate the quality of data in the Thematic Report on Mortality is the Brass Growth Balance Equation (BGBE). The application of this method provides an overall percentage of the under-enumeration of deaths reported to have occurred in a household during the past 12 months (separately by sex). This percentage is applied to each age group from five to nine years and over. It is assumed that the completeness of recording of deaths is the same for all ages over a certain age (15 years). Regarding maternal mortality, the recommended practice is to apply the percentage of under-enumeration of

deaths corresponding to the female population to the registered number of maternal deaths. It is assumed that a maternal death has the same probability of being under-reported as any other death.

Four measures of maternal mortality were estimated, namely: (i) the maternal mortality ratio (MMRatio), (ii) the maternal mortality rate (MMRate), (iii) the proportion of adult female deaths due to maternal causes (PMFD), and (iv) the lifetime risk of maternal death (LTR). Different aspects of the level of maternal mortality are reflected in each of the indicators described above. Of them, most consideration has been given to the MMRatio, but a variety of indicators are needed to understand the level and pattern of maternal mortality.

The application of the BGBE method to the female adult mortality data from the 2014 Census indicated a completeness rate of recorded deaths of 62.5 per cent; therefore, the number of maternal-related deaths had to be adjusted upwards by 37.5 per cent. The reported number of maternal-related deaths was 2,034 cases; therefore this was increased to 2,797 cases. Using this adjusted number of maternal deaths, the MMRatio was calculated at 282 maternal deaths per 100,000 live births. The MMRate (the risk of maternal death per pregnancy or birth), was also calculated; this was 0.209. While the MMRatio indicates obstetric risk, the MMRate indicates the risk of maternal deaths among women of reproductive age. The proportion of adult female deaths due to maternal causes (PMFD) is of more direct interpretation; 10 per cent of female deaths among women of reproductive age are attributed to maternal deaths. Finally, the lifetime risk of maternal death (LTR) is 7.3 per 1,000 women.

An additional piece of information is the percentage distribution of the timing of maternal mortality. The highest percentage of deaths take place after delivery (38.5 per cent), followed by deaths during delivery (32.4 per cent), and, lowest of all, during pregnancy (29.1 per cent). This distribution of the timing of maternal mortality is consistent with the experiences of most countries.

In spite of the possible under-reporting of deaths, the 2014 Census provides reliable estimates of maternal mortality. The development of methods that allow for evaluation and adjustment of data has been pivotal in this effort. The indicators of maternal mortality levels presented in this report may not be exact, but they are reliable and accurate enough to be used in policymaking and public health planning.

Following the estimates of maternal mortality indicators, two more analyses were conducted; an examination of the spatial distribution of maternal mortality, and a study of selected differentials. Two theoretical frameworks were applied to provide conceptual support for interpreting the results of these analyses, as well as for making recommendations for further research. These two frameworks are "the three delays model" and "the intermediate determinant model."

One of the advantages of census information on maternal mortality is the availability of data to estimate indicators at the subnational level. Therefore, maternal mortality was estimated for urban and rural areas, and at the first level of administrative subdivision of Myanmar, the State/Region.

Maternal mortality levels in rural areas were found to be higher than in urban areas. Also, within the 15 States/Regions, substantial variations were found. An attempt was made to identify possible explanations of these differences. Six variables that refer to State/Region socioeconomic characteristics were correlated with the MMRatio. The results of this analysis helped to better understand maternal mortality and its possible determinants.

A second analysis was conducted with additional data in order to gain new insights into the maternal mortality spatial distribution. Several indicators of the availability of health services in the 15 States/Regions, were considered. Correlation coefficients were computed between each indicator and the MMRatio. None of the indicators were significantly related to maternal mortality levels. Explanations and interpretations to this unexpected result have been suggested. Further research in this area is recommended.

Selected maternal mortality differentials were examined. These differentials refer to some characteristics of the household where the deceased women lived. They are mainly indicators of economic and social disadvantage. All of them were found to be related to maternal mortality as expected, that is, maternal mortality levels are higher in those households with low socioeconomic status.

These analyses and the interpretation of their results using the two theoretical frameworks mentioned above (the three delays model and the intermediate determinant model) identified several issues relevant to maternal mortality policies and interventions. For example, this study indicates that there are several factors that prevent women looking for, accessing and receiving basic and emergency obstetric care, as well as maintaining good health before, during and after delivery. These factors could be characteristics of individuals or communities, and refer mainly to socioeconomic attributes. Therefore, the most relevant policy interventions are those that facilitate disadvantaged women looking for, reaching, and receiving health care, especially in remote areas of the country. The results from this analysis indicate that maternal health care services are not reaching all the population groups that they should: women with limited education, in low-income families and living in poor communities are more likely to be marginalized from accessing and receiving basic and emergency obstetric care (in addition to probably having a lower health status).

It is important to recognize that this is a basic study of maternal mortality, aimed at producing basic indicators and preliminary analyses. While census data has many advantages over alternative data sources for measuring maternal mortality, information from censuses may not be sufficient to study systemic and structural issues related to maternal mortality. Health statistics, survey studies, and qualitative research may be more appropriate. Nevertheless, census data may provide a quantitative overall basis for these more detailed studies.

Chapter 1. Introduction

Over the past three decades, high levels of maternal mortality in the developing countries have been increasingly recognized as a pressing public health issue. During the Safe Motherhood Conference, held in Nairobi, Kenya, in 1987, high maternal mortality in the developing countries finally received attention from the international community. A striking fact was that maternal mortality ratios (defined as the number of maternal deaths during a given period per 100,000 live births in the same period) in the developing countries at that time were about 100 times greater than those in the developed countries. Maternal mortality was identified as the health indicator with the greatest disparity between the developed and developing countries. Following Nairobi, maternal mortality was discussed at several conferences including: the United Nations World Summit for Children at the United Nations Headquarters in 1990; the International Conference on Population and Development (ICPD), Cairo, Egypt, 1994; and the Fourth World Conference on Women, Beijing, China, in 1995. It was agreed, during these conferences, that maternal mortality needed to be drastically reduced. This goal was reaffirmed by the Programme of Action approved by the 1999 ICPD+5 in The Hague, the Netherlands (Hill, Stanton and Gupta, 2001; WHO, 2013).

Subsequently, in September 2000, world leaders met at the United Nations Headquarters in New York for the United Nations Millennium Declaration. The outcome of this meeting was the Millennium Development Goals (MDGs), a set of eight time-bound anti-poverty targets that countries pledged to achieve by 2015. One of these goals, the fifth, was to improve maternal health. Each goal contained several targets, the first target of MDG 5 was to reduce the maternal mortality ratio by three quarters between 1990 and 2015.

Substantial progress was made in achieving the MDGs. Maternal mortality fell by almost 44 per cent worldwide, from 385 deaths to 216 deaths per 100,000 live births over the period 1990 to 2015 (WHO et al, 2015). This translates into an average annual rate of reduction of 2.6 per cent. Although this was a substantial decline, it was less than half of the 5.5 per cent rate needed to achieve the three-quarters reduction in maternal mortality targeted for 2015 in MDG 5. In general, the ignominy of poverty has not ended at all. In 2016, members of the United Nations agreed on 17 Sustainable Development Goals (SDGs) to be achieved by 2030. This new set of goals aims to complete the agenda of the MDGs so that no country is left behind (UNDP, 2015). Health is the third goal of the SGDs; one of its targets is to reduce the maternal mortality ratio to less than 70 per 100,000 live births by 2030.

The Government of Myanmar made a strong commitment to achieve the goals of the Programme of Action of the International Conference on Population and Development (ICPD) and the MDGs, and is committed to the SDGs and other international development goals and targets. The Reproductive Health Policy and Strategic Plans on Reproductive Health (2004-2008 and 2009-2013) of Myanmar's Ministry of Health can be considered as national responses to these international initiatives. More recently, the Government issued the *Five-Year Strategic Plan for Reproductive Health* 2014-2018 (Department of Health, 2014). However, despite political commitment and continuous efforts by the Ministry of Health and its partners, reproductive health services need to be improved further, and, in particular, more effort needs to be made to effect a decline in maternal mortality in Myanmar, as illustrated in this report. The Government acknowledges that intensive efforts are required in order to expedite the progress towards improving maternal health.

The concerns about maternal mortality, and the interest in its reduction, motivated by the world's attention to maternal health, has resulted in an increasing demand for estimates both at the national and subnational levels. However, in most developing countries maternal mortality data are simply not available or are inadequate for providing accurate estimates. Maternal mortality data should be provided by civil registration systems, but they are not able to collect complete and reliable statistics on maternal deaths. Even in some developed countries, maternal mortality data remains insufficient in terms of the quality of recording (Bouvier-Colle et al, 1991). Household surveys have been increasingly used to measure maternal mortality. However, they require excessively large sample sizes to produce reliable estimates, not to mention subnational level estimates (Stanton et al, 2000; Stanton et al, 2001; WHO, 2013).

Given the limitations of maternal mortality data from civil registration systems and surveys, population and housing censuses are increasingly being seen as the only source for producing reasonably accurate estimates of maternal mortality (Stanton et al, 2001; WHO, 2013). The United Nations has recommended that in countries with no, or poor, registration of deaths, censuses should include questions on deaths in a household (by age and sex) during a short reference period, such as twelve months, prior to the census enumeration (UN, 2008). The addition of this module allows for the inclusion of questions regarding maternal deaths among women of reproductive age. The specific questions are examined in the next chapter. During the 2010 round of Population and Housing Censuses several countries included the questions on maternal mortality with mixed results (Leone, 2013). In general, valuable knowledge for measuring maternal mortality was gathered by the inclusion of such questions.

There are several advantages of estimating maternal mortality using census data over alternative measurement approaches. Firstly, censuses provide a large enough number of observations sufficient to conduct analyses of maternal mortality at the subnational level. Surveys seldom have a sample size large enough to provide accurate estimates by State/Region or subgroup. Secondly, censuses allow for disaggregated analysis by background characteristics, such as indicators of household's socioeconomic status. Even vital registration systems often lack this background information. Thirdly, if the census includes questions on recent household deaths, the additional cost and time to identify a maternal death is minimal. The additional questions are likely to be asked in less than one per cent of households, thus minimizing interviewer and data processing time. Fourthly, there is a wealth of knowledge and experience in the analysis, evaluation, and adjustment of census data on recent deaths by age (UN, 1983; Moultry et al, 2011). Demographic methods are available to evaluate the data on maternal mortality indicators, and correction factors are applied to allow for the adjustment of estimated data quality problems (Hill, Stanton and Gupta, 2001).

There are, however, some shortcomings in using the census to collect information to obtain maternal mortality indicators. The most obvious relates to the general questions on mortality in a household that precede any specific question on maternal mortality. It seems a common occurrence that some households fail to report a death because of taboos, beliefs, traditions, or emotional reasons. To report or talk about a recent death is often an emotionally difficult experience. This problem results in an under-estimation of maternal mortality. However, it may also be the case that people confuse a death in the household with a death of a family

member in another household, resulting in the same death being reported in more than one household. In this case maternal mortality tends to be over-estimated. Errors in the perception of the 12-month period prior to the census may also result in an over- or under-estimation of maternal mortality.

The Myanmar 2014 Census collected the requisite information that is adequate to measure maternal mortality. Questions on deaths in households during the 12 months prior to the Census enumeration were included in the questionnaire, as well as questions on indicators of maternal mortality. This current report presents the results, evaluation, analysis and interpretations based on the collected data. It is expected that these results will be useful to identify the level of maternal mortality at the national and State/Region levels, and to improve interventions to reduce maternal mortality. Previous attempts have been made to measure maternal mortality in Myanmar (the results from these studies are discussed later in Chapter 3). However, this is the first attempt to use a source of data and a methodology that is internationally accepted as satisfactory and reliable to estimate maternal mortality. It is also important to take into account that there are time constraints associated with the dissemination of census results. Further analyses within the time frame of the programme of the 2014 Census thematic reports are not easy to carry out. At this stage the analyses are mostly of a descriptive nature, even though some of them involve methodologically complex applications.

Some people in three areas of the country were not enumerated. This included an estimate of 1,090,000 persons residing in Rakhine State, 69,800 persons living in Kayin State and 46,600 persons living in Kachin State (see Department of Population, 2015 for the reasons that these populations were not enumerated). In total, therefore, it is estimated that 1,206,400 persons were not enumerated in the Census. The total estimated population of Myanmar on Census Night, both enumerated and non-enumerated, was 51,486,253.

The analysis in this report covers only the enumerated population. It is worth noting that in Rakhine State an estimated 34 per cent of the population were not enumerated. Consequently, data for Rakhine State, as well as for several Districts and Townships within the State, are incomplete, and represent only part of the population. However, basic analyses conducted here indicate that the under-enumeration of certain population groups has only had a limited effect on the measurement of mortality indicators included in this analysis.

Chapter 2. The measurement of maternal mortality using data from the 2014 Census

Maternal mortality measures use data on the population by age and sex, the number of deaths by age and sex, and the number of maternal deaths (preferable by age) over a given reference period, usually 12 months (as it was in the Myanmar Census). The number of live births over the same period is also necessary to calculate the maternal mortality ratio, which is the most common indicator of maternal mortality (see below for a definition). Specifically, data collection on household deaths requires the identification of all household members who have died within the specified period prior to the Census, and also the sex and age of each deceased person. Maternal deaths were identified in the 2014 Census from questions aimed at determining the timing of a woman's death relative to pregnancy, childbirth, and the postnatal period. These questions referred to deceased women of reproductive age (15-49). Trained enumerators recorded the information on deaths in households within the required boxes in the census questionnaire.

Figure 2.1 shows the section of the 2014 Myanmar Census questionnaire that collected data on deaths in households. It was the last question in the household form. Three distinct timing-of-death questions were included, as shown, to identify whether death occurred during pregnancy, during delivery or during the first six weeks after delivery.

Figure 2.1
Maternal mortality related questions in the 2014 Census

These questions follow the UN's recommendations on the collection of data on maternal mortality, which also includes the careful training of data collection personnel, and the allocation of extra training time to cover questions on maternal mortality (UN, 2008). All these requirements were fulfilled in the Myanmar Census.

A maternal death according to the International Classification of Diseases, Tenth revision is:

> The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 1993).

An actual maternal death requires information on the specific cause of death. This is different from a pregnancy-related death, which is determined solely by the timing of death relative to pregnancy, childbirth and the postnatal period. Hence, a "pregnancy-related death" is, "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of cause" (WHO, 1993).

The questions on maternal mortality in the 2014 Census, as in most censuses, identify pregnancy-related deaths rather than true maternal deaths. Nevertheless, regardless of the definition used, in most countries the results are usually reported as maternal deaths and the analysis refers to maternal mortality. The two terms are used interchangeably in this report, unless one of the terms is explicitly stated.

Taking into account the data issues for estimating maternal mortality noted in Chapter 1, an assessment of the data is vital. The data required for estimating maternal mortality from a census comes from the number of deaths that took place in a household during the 12 months prior to the census. However, data from this source usually have errors, which could result in an under- or over-enumeration of deaths. Therefore, an initial step in estimating maternal mortality is to evaluate the completeness of the recorded number of female deaths.

The 2014 Census Thematic Report on Mortality discusses childhood and adult mortality (Department of Population, 2016a). In that report a full evaluation was conducted regarding the completeness of deaths recorded in the Census from the questions on deaths in a household during the preceding 12 months. There are several methods available for this evaluation. Most of them are based on the mathematical relationship between the age distribution of deaths and the age distribution of the population. The method used in the Mortality report is the Brass Growth Balance Equation (BGBE), which is easy to apply and conceptually simple (Dorrington, 2013). In addition, it is applicable when data from only one census are available, as is the case in Myanmar. This method was employed separately for males and females, and only for the adult population aged 15 years and over.

The application of this method provides an overall percentage of the under-enumeration of deaths reported to have occurred in a household during the 12 months prior to the Census (by sex). This percentage is applied to each adult age group. It is assumed that the completeness of the recording of death is equal for all ages over a minimum age, usually 15 years.

In regard to maternal mortality, the recommended practice is to apply the percentage under-enumeration of the female population to the reported number of maternal deaths. It is assumed that a maternal death has the same probability of being under-reported as

any other death. The three questions regarding the timing of maternal-related deaths in the questionnaire are likely to improve recall and, therefore, the classification of a maternal death as a non-maternal death is unlikely.

The application of the BGBE method to the female adult mortality data from the 2014 Census indicated a completeness of recording of deaths of 62.5 per cent. This means that the number of female deaths recorded in the 2014 Census and, therefore, the number of maternal related deaths, had to be adjusted upwards by 37.5 per cent. The reported number of maternal-related deaths was 2,034 cases, which was adjusted to 2,797 cases.[1]

The calculation of the maternal mortality ratio (MMRatio), the main maternal mortality indicator, also requires the number of births. This was obtained from the data on children born during the 12 months prior to the Census[2]. The usual practice is to adjust this number of births for a possible under-enumeration. This adjustment is typically made by using an indirect method, which in this case was a variation of the original Brass P/F ratio[3] procedure that takes into account changes in fertility observed in Myanmar over the decades prior to the Census. A detailed description of this method is included in the 2014 Census Thematic Report on Fertility and Nuptiality (Department of Population, 2016b). The unadjusted number of births during the 12 months prior to the Census was 906,493 and the adjusted number was 993,294, that is, the estimated under-enumeration of births was 8.7 per cent, which is acceptable for a census.

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[1] The application of the BGBE method to female adult mortality (and also male) is described in the 2014 Census Thematic Report on Mortality (Department of Population, 2016a).

[2] Data on recent births to ever-married mothers aged 15 years and over was obtained with four questions: month and year of last live birth, sex of the last live birth, and whether or not the last live birth was alive at the time of the Census. The purpose of the first two questions was to obtain information on the number of births to women during the 12 months prior to the Census, from the beginning of April 2013 through to the end of March 2014. Note: that because the fertility questions are asked of ever-married women only, it is assumed that never married women have a statistically negligible number of children.

[3] In the P/F ratio method formulated by William Brass, data on children ever born are used to adjust upward for the under-reporting of the number of births reported to have occurred during a year prior to a census or survey. For a complete description of this method see UN, (1983).

Table 2.1 shows the adjusted and unadjusted number of female deaths and maternal deaths by age group. Only females of reproductive age are included. The adjusted and unadjusted number of births is also shown.

Table 2.1
Female population, number of female deaths during the 12 months prior to the Census, maternal deaths and number of births, by age group corresponding to female's reproductive period, unadjusted and adjusted, 2014 Census

Age groups	Female population	Unadjusted			Adjusted*		
		Deaths	Maternal deaths	Births	Deaths	Maternal deaths	Births
15 – 19	2,219,179	1,488	124	48,299	2,046	171	74,586
20 – 24	2,113,670	1,763	372	199,995	2,425	512	227,757
25 – 29	2,060,713	2,045	367	244,233	2,812	505	268,533
30 – 34	1,956,452	2,489	409	207,148	3,422	562	216,239
35 – 39	1,816,129	3,042	425	135,363	4,182	584	138,329
40 – 44	1,700,639	3,709	243	58,887	5,098	334	56,436
45 – 49	1,543,961	4,276	94	12,568	5,877	129	11,414
Total	**13,410,743**	**18,812**	**2,034**	**906,493**	**25,862**	**2,797**	**993,294**

* Figures for adjusted births are taken from the Thematic Report on Fertility and Nuptiality, 2014 Myanmar Census.

Table 2.2 shows the main measures of maternal mortality calculated from the unadjusted data (see below for the definition of each indicator). Comparing the results presented in these two tables (see Tables 2.2 and 3.2) indicates how much the adjustment of adult mortality carried out elsewhere in this report affects the estimate of maternal mortality.

Table 2.2
Maternal mortality indicators, 2014 Census (unadjusted)

Age groups	ASFR	MMRatio	MMRate	PMFD	LTR	No. of maternal deaths
15 - 19	0.0218	256.7	0.056	0.08	0.3	124
20 - 24	0.0946	186.0	0.176	0.21	0.9	372
25 - 29	0.1185	150.3	0.178	0.18	0.9	367
30 - 34	0.1059	197.4	0.209	0.16	1.7	409
35 - 39	0.0745	314.0	0.234	0.14	1.2	425
40 - 44	0.0346	412.7	0.143	0.07	0.7	243
45 - 49	0.0081	747.9	0.061	0.02	0.3	94
Total	**2.29**	**224.4**	**0.152**	**0.11**	**5.3**	**2,034**

Before presenting the results of this analysis, it is important to first define the four main maternal mortality measures used in the report.

The most commonly used measure of maternal mortality is the maternal mortality ratio, or *MMRatio*, which refers to the number of maternal deaths per live births, multiplied by a conventional constant of 100,000. Thus:

MMRatio = (Number of maternal deaths / Number of live births) x 100,000.

While the MMRatio expresses obstetric risk, the maternal mortality rate, or *MMRate*, which refers to the number of maternal deaths per women aged 15-49, is an indicator of the risk of maternal death among women of reproductive age. The MMRate is usually multiplied by a constant of 1,000. Thus:

MMRate = (Number of maternal deaths / Number of women aged 15-49) x 1,000.

A third indicator is the proportion of adult female deaths due to maternal causes (PMFD). Thus:

PMFD = Number of maternal deaths / Number of deaths among women aged 15-49

A fourth indicator is the lifetime risk of maternal death (LTR). This reflects the chances of a woman dying from maternal causes over the course of her 35-year reproductive lifespan. This indicator takes into account the probability of a death occurring due to maternal causes each time a woman becomes pregnant. A common way of calculating the LTR is:

LTR = 35 x MMRate[4]

Different aspects of the level of maternal mortality are reflected in each of the indicators described above. Among them, the MMRatio has been given the most consideration. But a variety of indicators are needed to understand the level and pattern of maternal mortality (Hill, Stanton and Gupta, 2001).

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[4] This formula, which was used to calculate the values in Table 3.2, does not take into account mortality risks by other competing causes. An alternative formula is (T15-T50)/l5 x MMRate (WHO, 2013). This formula does consider mortality risks by other competing causes. However, the differences are quite small. This latter formula gives a LTR of 7.1 instead of 7.3.

Chapter 3. Maternal mortality at the Union level

Using the adjusted number of maternal deaths and the adjusted number of births, the maternal mortality ratio was calculated. The result is 282 maternal deaths per 100,000 live births. A confidence interval for this estimate was calculated. With a two-tails 95 per cent confidence interval, the ratio varies between 176 and 387 deaths per 100,000 births[5]. In general, confidence intervals are used only for parameters calculated from samples. However, in the case of a census this exercise is justified on the grounds that a census can be viewed as a sample of many similar enumerations conducted at different times.

Table 3.1
Mortality indicators, Myanmar (2014 Census), major global areas and regions

Mortality indicator	Myanmar***	Southeast Asia	Developing countries	Developed countries	World
Maternal mortality ratio *	282	140	230	16	210
Crude death rate **	9.6	6.9	7.4	10.0	7.8
Life expectancy at birth **	64.7	70.3	68.8	78.3	70.5
Male	60.2	67.5	66.9	75.1	68.3
Female	69.3	73.2	70.7	81.5	72.7
Infant mortality rate **	62	24	39	5	36
Under-five mortality rate **	72	30	54	6	50

Sources:

* WHO, UNICEF, UNFPA, WB, UNPD, 2014 (data refers to 2013).

** UNPD, 2015 (data refers to 2010 – 2015). *Crude death rate* is the number of deaths that take place in a given year divided by the population in the middle of that year. It is usually multiplied by 1,000. *Life expectancy at birth* is the average number of years that a newborn baby is expected to live if the mortality conditions of the year corresponding to the life table remains constant; *Infant mortality rate* is the number of deaths of infants aged under age one per 1,000 live births; *Under-five mortality rate* is the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before reaching the age of five if subject to current age-specific mortality rates.

*** The source for Myanmar indicators is the 2014 Census.

Table 3.1 shows the maternal mortality ratio for Myanmar, according to the 2014 Census and for other areas and regions in the world. The table also shows other mortality indicators that may help to place maternal mortality within a broader picture.

In general, mortality indicators point to overall high mortality levels in Myanmar. For example, life expectancy at birth, the most frequently used mortality indicator, is four years lower than the average in developing countries, and over five years lower than the average in the Southeast Asian region. Infant mortality, which is one of the most frequently used indicators

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[5] The intervals were computed using the following procedure. Assume that p (the proportion of maternal deaths in the total number of live births) follows a binomial distribution, then:

    p = MD/LB, where, MD is the number of maternal deaths and LB is the number of live births

    MMRatio = (MD/LB)*100,000

    q = 1-p

    n = total number of live births = LB

    Mean = n x p

    Variance = n x p x q

    Standard error (SE) = square root of the variance

    95 per cent confidence interval = MMRatio ± 2 x SE

to determine the health status of a population, is more than two times higher than that observed in Southeast Asia, and almost two times higher than that in developing countries. Male life expectancy at birth, which is a direct indicator of mortality rate, shows an extremely lower than average level in the region and further impacts on the high Union average. Therefore, the estimated higher than average level of maternal mortality is consistent with the high mortality levels prevailing in the country. As noted in Chapter 1, the Government is aware that concerted efforts need to be made in order to reduce maternal mortality (Department of Health, 2014).

Table 3.2 shows the four indicators of maternal mortality described in Chapter 2. The table shows not only the total value of the indicators, but also the values by age group. It includes age-specific fertility rates (ASFRs), since they are useful for analytical purposes, as well as the total fertility rate[6]. The table also includes estimates of the absolute number of maternal deaths.

One of the most striking results in Table 3.2 is the MMRatio corresponding to the age group 45-49 years; some 1,132.4 deaths per 100,000 live births. This level is about four times higher than the overall ratio. Although women in this age group experience neither the largest number of maternal deaths nor the highest percentage of deaths due to maternal causes, they do have the greatest obstetric risk, that is, the highest risk associated with each pregnancy. In general, it is expected that as age increases, after age 30, maternal mortality rates also increase. This pattern can be observed in Table 3.2. However, the jump from age 40-44 to 45-49 is substantial, almost double. It is likely that age is not the only factor that is contributing to the high obstetric risk of women aged 45-49 years. Having children at this advanced age may be the result of social and economic disadvantages that limit women's access to contraception and reproductive health information. This vulnerable position, combined with their advanced age, significantly increases the risks associated with each of their pregnancies.

Table 3.2
Maternal mortality indicators, 2014 Census

Age groups	ASFR*	MMRatio	MMRate	PMFD	LTR	No. of maternal deaths
15 - 19	0.0332	228.6	0.077	0.083	0.4	171
20 - 24	0.1087	224.6	0.242	0.211	1.2	512
25 - 29	0.1292	187.9	0.245	0.179	1.2	505
30 - 34	0.1124	260.1	0.287	0.164	1.4	562
35 - 39	0.0765	422.5	0.322	0.140	1.6	584
40 - 44	0.0334	592.0	0.196	0.066	1.0	334
45 - 49	0.0075	1,132.4	0.084	0.022	0.4	129
Total	**2.51**	**281.6**	**0.209**	**0.098**	**7.3**	**2,797**

Source: Department of Population, 2016b.

[6] The age-specific fertility rates are the number of live births within the 12 months preceding the census divided by the female population for each five-year age group within reproductive age (conventionally, from 15 to 49 years). The total fertility rate, or TFR, is the sum of the seven age-specific fertility rates multiplied by five. It indicates the average number of live births that women will have at the end of their reproductive life if the present level and age structure of fertility remains constant in the future.

The MMRate is the indicator of maternal death risk among women of reproductive age (15-49 years). This indicator is expressed conventionally as per 1,000 women in this age group. Table 3.2 reports this as 0.209. However, it can be expressed in units of per 10,000 or 100,000 women as well. Then, its value is 2.1 or 21 maternal deaths, respectively. According to Table 3.2, the highest rate is among women aged 35-39 years old. This measure reflects not only the risk of maternal deaths per pregnancy, but also the level of fertility. Compared to other age groups, the 35-39 age group combines a higher than average risk of maternal death, with a fertility level relatively high for this group who are of prime reproductive age. A similar pattern can be observed in the column of lifetime risk of maternal deaths (LTR)[7]. The same interpretation is valid for this indicator.

The proportion of female deaths which are maternal (PMFD) is 0.10, which means that 10 per cent of all deaths among women of reproductive age are attributed to maternal deaths. The age distribution is much as expected. However, the value for the age group 20-24 seems to be higher compared with the surrounding values, where, in fact, it might be expected to be lower than the proportion corresponding to the age group 25-29. This pattern requires a more detailed analysis and is examined below.

From the results there is a clear pattern, with the proportion of deaths due to maternal causes decreasing, as age increases, reaching only 2 per cent among women aged 45-49. The number of births among this oldest age group is very small (see Table 2.1). However, as indicated above, the risk of death associated with each of their pregnancies is the highest (1,132 per 100,000 live births – Table 3.2). It is also important to point out that this measure represents a very simple and understandable way to quantify maternal mortality. The overall result indicates that 10 per cent of all deaths that occur among women of reproductive age are classified as maternal deaths. As shown in Table 3.2, among women aged 20-24 this percentage increases to 21 per cent.

Different features of the level of maternal mortality are indicated by each of the measures described above. MMRatio is the most widely used by analysts, policymakers and the international community. However, other indicators are also necessary to comprehend the level and pattern of maternal mortality. This is very clear in the interaction between fertility and maternal mortality. A decline in maternal mortality could simply be the result of a decline in fertility, even without any change in those factors that contribute to the risk of maternal deaths. A decline in the number of births results in fewer maternal deaths, even if no safe motherhood interventions have been implemented. Thus, trends in maternal mortality should be interpreted in light of the risk per woman per birth. This reasoning also applies to maternal mortality differentials. A region may exhibit lower maternal mortality levels only because its population has low fertility levels, and not because of the availability of a better health care infrastructure or a higher standard of living.

It is important to evaluate the classification of adult female deaths as pregnancy-related. There are no specifically developed methods for this assessment and there is limited knowledge of empirical regularities that can be used to compare results. The best that can be done is to observe patterns by age group (WHO, 2013). An important pattern to examine

[7] Please, see footnote 4. The formula used here to calculate this value does not take into account mortality risks by other competing causes.

is the proportion of female deaths due to maternal causes (PMFD) and the age-specific fertility rates (ASFR). The two distributions are expected to be similar, although the former is expected to be high at very young and old ages, reflecting the higher obstetric risks of women in these age groups. Figure 3.1 shows the plots of the PMFDs and ASFRs. In general, the PMFD follows the ASFR pattern except for one glaring deviation; the proportion corresponding to women aged 20-24.

This irregularity was noted above when the PMFD was examined, and where it was found that the proportion corresponding to the age group 20-24 was higher than that corresponding to the age group 25-29. The proportion in the former age group is expected to be lower than in the latter. The cause of this divergence may possibly be due to the large number of maternal deaths in the age group 20-24. Figure 3.2, which shows the distribution of maternal deaths by age group, may help to elucidate this pattern.

Figure 3.1

Age-specific fertility rates and proportion of deaths due to maternal causes, 2014 Census
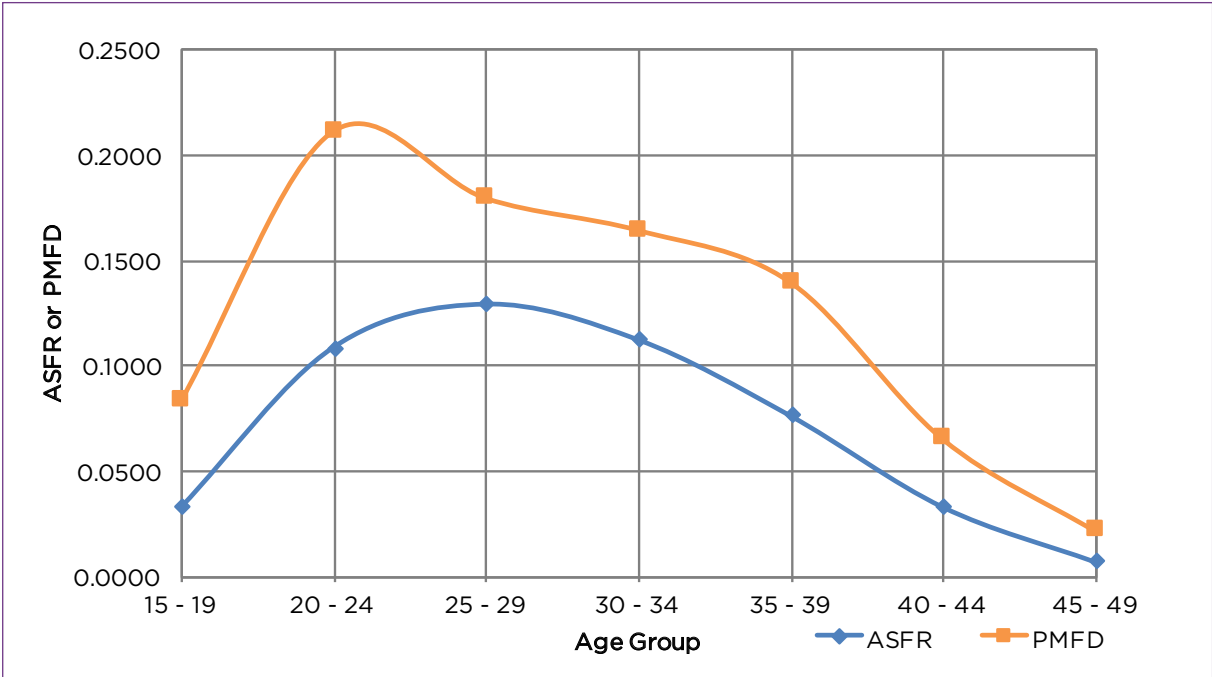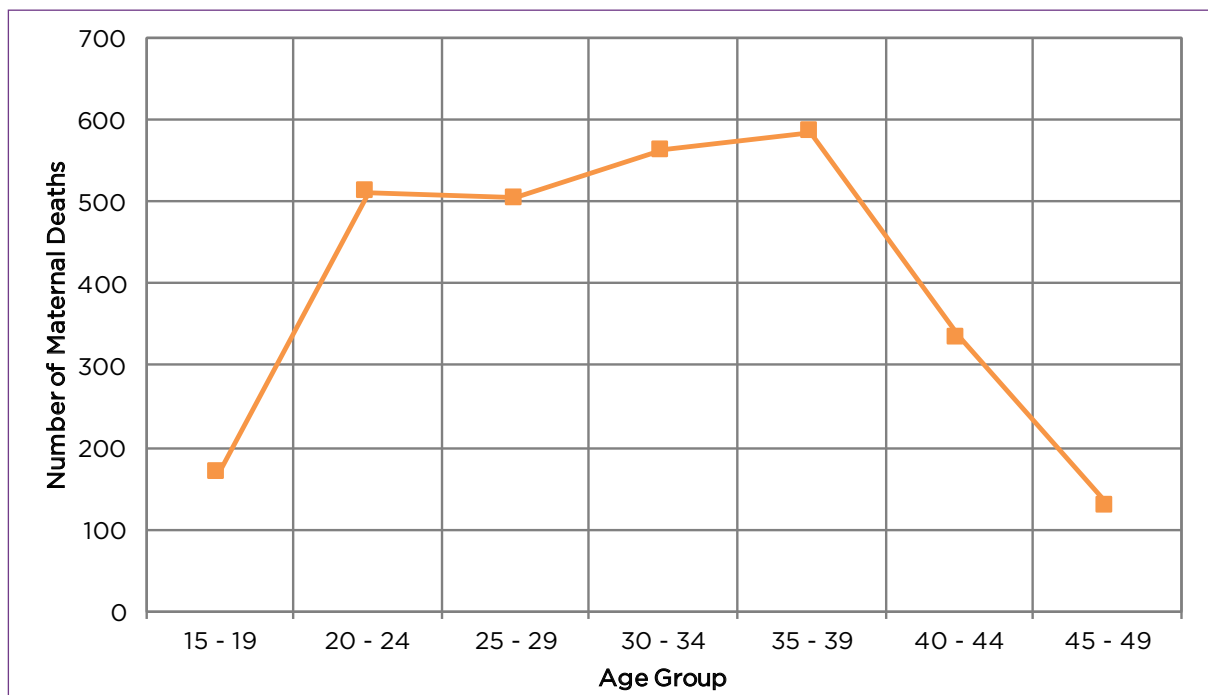
Figure 3.2

Number of maternal deaths by age group, 2014 Census

Maternal mortality in the age group 20-24 is similar to that at age 25-29. Then, expectedly, the number of maternal deaths increases in the age group 30-34. The similar number of maternal deaths in the age groups 20-24 and 25-29 is possible. It is likely that obstetric risks are similar in both age groups, considering that they represent the prime reproductive ages. The PMFD in the age group 20-24 is slightly higher because general mortality is lower than in the age group 25-29. Table 2.1 in Chapter 2 shows the overall mortality age pattern.

An additional hypothesis about this pattern was explored. The larger than expected number of maternal deaths in the age group 20-24 could be a result of an age declaration issue. Many maternal deaths reported among women aged 20-24 may have occurred among women aged 15-19 who, because of their young age, are particularly vulnerable. However, available evidence suggests that this is not the case. Age heaping is quite irregular regarding population, general mortality, and maternal mortality. Although there are some preferences for ages ending in 0 and 5, as well as for some other ages, the evidence is not sufficient to demonstrate a large misreporting in the age group 15-19 years in favour of the age group 20-24 years[8].

Therefore the bump corresponding to the PMFD of the age group 20-24 in Figure 3.1 appears to be genuine. The available evidence suggests that it is not a result of incorrect age reporting or some other data error. It is important to point out, however, that these basic evaluations

[8] An examination of maternal deaths by single age points to age heaping at ages 20 and 22. However, it may not necessarily be entirely caused by age misreporting in the age group 15-19. It may also be the result of single age misreporting within the interval 20-24 years. The number of reported maternal deaths at age 19 was 44. At the age of 20 it increased to 82 deaths, and then declined to 60 deaths at age 21. Then, at age 22 it increased again to 95 deaths, before declining again to 66 and 69 deaths at ages 23 and 24, respectively.

are rather subjective and should be interpreted with extreme care. It is not advisable to conclude too quickly that a result is erroneous since it may be a genuine pattern (although this might not always be the case and the opposite could be true).

Plotting the MMRatio by age provides an additional informal visual check. This measure is expected to follow a J-shape by age group. The pattern shown in Figure 3.3 follows a marginal decline between 15-19 and 25-29 years, then starts to increase, slowly at first to age 35-39, then more rapidly. This means that when obstetric risk is considered, the age distribution is likely to be reliable. It is important to repeat, however, that these checks are rudimentary and they are by no means the starting point for a formal evaluation or adjustment of any data deficiencies.

Figure 3.3

Maternal mortality ratios, 2014 Census
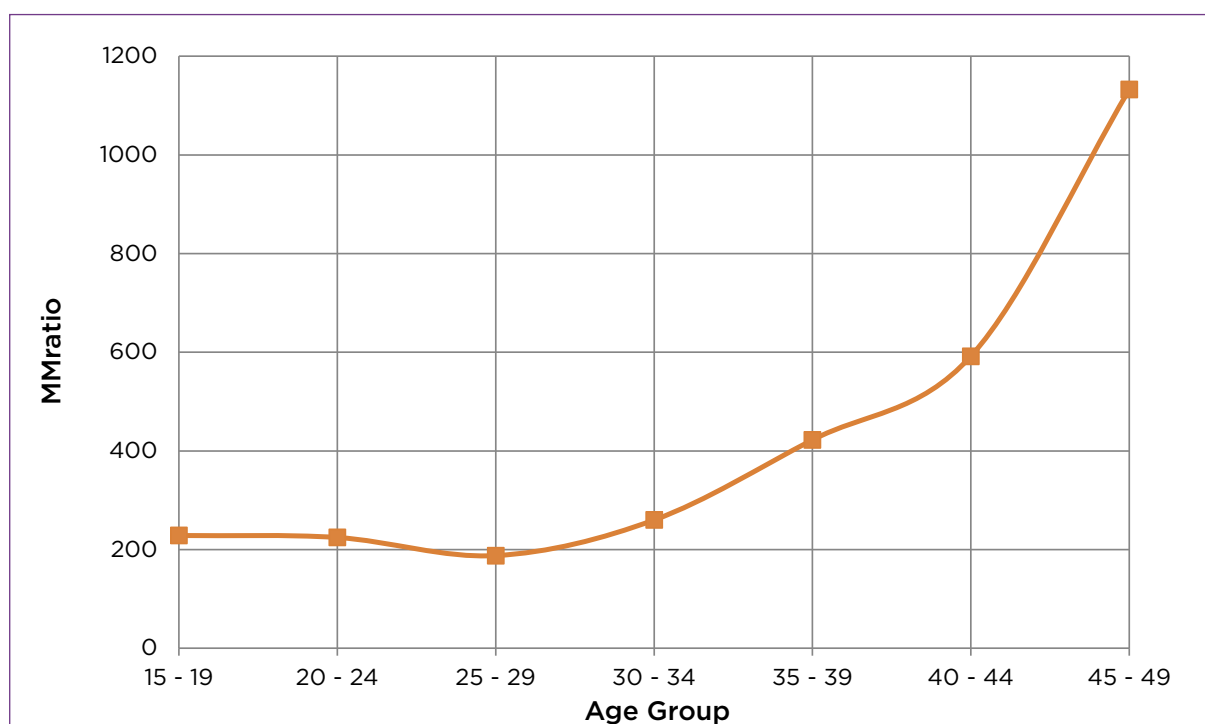
An additional piece of information is presented in Table 3.3. This shows the percentage distribution of the timing of maternal mortality, which occured during pregnancy, delivery or the first six weeks after delivery. Deaths occurring after delivery account for the highest percentage of deaths (38.5 per cent), followed by those during delivery (32.4 per cent), while the least number of deaths occur during pregnancy (29.1 per cent).

This distribution of the timing of maternal mortality is consistent with experiences of most countries (Institute for Health Metrics and Evaluations, 2015). However, the timing of maternal mortality by age groups is more difficult to interpret. Patterns are not clear, and random factors are likely to be affecting the distribution. Further analyses of this topic are, however, not possible considering the available information and the scope of this present report.

In summary, the measurement of maternal mortality from the 2014 Census has provided reliable results which can be compared with independent estimates.

Table 3.3

Percentage distribution of the timing of maternal mortality, and adjusted number of maternal deaths by age group, 2014 Census

Age groups	Percentage distribution of maternal deaths occurring				Adjusted number of maternal deaths
	During pregnancy	During delivery	In the first 6 weeks after delivery	Total	
15 - 19	26.6	32.3	41.1	100	171
20 - 24	19.1	35.5	45.4	100	512
25 - 29	30.8	29.7	39.5	100	505
30 - 34	29.6	30.1	40.3	100	562
35 - 39	29.4	37.2	33.4	100	584
40 - 44	31.3	33.3	35.4	100	334
45 - 49	55.3	17.0	27.7	100	129
Total	**29.1**	**32.4**	**38.5**	**100**	**2,797**

An important comparative source of data on maternal mortality is the effort to estimate maternal mortality in most countries in the World undertaken by WHO, UNICEF, UNFPA, the World Bank and the United Nations Population Division (2014). This inter-agency undertaking includes countries with complete and reliable data, countries with incomplete or deficient data, and countries with no data at all; Myanmar is among the latter. For these countries the MMRatio was modelled on the basis of a set of covariates, that is, other variables for which data were available and that could explain the phenomenon. The model was fitted with three selected covariates: (i) gross domestic product per capita (GDP), expressed in terms of purchasing power parity (PPP) units in US dollars at 2005, (ii) general fertility rate (GFR), live births per woman aged 15-49 and, (iii) skilled attendants at birth (SAB) as a proportion of live births, and random intercept effects for countries and regions.

According to this model, the MMRatio in Myanmar was 200 maternal deaths per 100,000 live births in 2013. This ratio is lower than that derived from the 2014 Census data (282). However, this difference may not be statistically significant considering that it is within the confidence interval computed with the 2014 Census data (176 to 387). Similarly, the range of uncertainty established in the inter-agency estimate ranged from 120 to 350 maternal deaths per 100,000 live births. The Census estimate is thus within this range. In spite of being clearly different, this difference is not statistically significant, that is, it can be considered to be caused by random factors. It may be difficult to accept that this difference is unimportant from a statistical point of view, but it is the level that this analysis provides.

It is important to emphasize that, as the two methods and data sources of these two estimates are completely different, they would not be expected to produce the same results. Very similar results would be coincidental. A superficial analysis is likely to conclude that because they are different, they should be evaluated to determine which of the two is more accurate. However, the previous analysis based on the approach of confidence intervals indicates that the two estimates are statistically similar or, in other words, they are not significantly different

from a statistical viewpoint. Usually, this analysis is not conducted when the parameters from two data sources are compared (typically a census and a survey).The outcome is often endless discussions on which instrument provides more accurate information. Although the two maternal mortality estimates are not statistically different, the 2014 Census estimates of maternal mortality will be used in this analysis.

A second maternal mortality estimate and analysis was published by the Maternal and Reproductive Health Division (Maternal and Reproductive Health Division, 2013), using data based on computed births provided by the Ministry of Health. The MMRatio estimate was 103 deaths per 100,000 live births in 2013. This value is outside the confidence interval corresponding to the 2014 Census estimates as well as the inter-agency estimates. It is derived using actual maternal death data and not data on pregnancy-related deaths. This difference, however, cannot explain the large difference from the estimate obtained from the 2014 Census. The Ministry of Health data are likely to be affected by serious under-estimation, as clearly and explicitly acknowledged in the publication.

It is important to view the rates from these analyses as complementary. For example, according to the Ministry of Health report, 11 per cent of all registered maternal deaths are "incidental deaths", which are pregnancy-related but not strictly maternal. If this percentage is applied to the number of pregnancy-related deaths estimated from the 2014 Census, the MMRatio based on actual maternal deaths would be 251 deaths per 100,000 live births. This is just an example of how one study may complement the other. To get more accurate results, an additional examination of the data would be needed. On the other hand, the 2014 Census provides a solid base to evaluate under-reporting of maternal deaths, as well as the number of births, not to mention a population figure which acts as the denominator for several mortality indicators.

Chapter 4. Two conceptual frameworks for the maternal mortality analysis

In this analysis two theoretical frameworks are applied to provide conceptual support for interpreting the analyses, as well as for interpreting results and recommending further research.

The first framework is the "three delays model" (Thaddeus and Maine, 1994; Barnes-Josiah, Myntti and Augustin, 1998). According to this model, the risk of a maternal death is strongly related to the possibility that a woman has to deliver in a facility that has services for basic and emergency obstetric care. However, there are different barriers that women face to reach the care provided by such facilities. The model identifies three groups of delay factors which may prevent women from accessing the level of maternal health care they need:

(i) a delay in the decision to look for care, which may be affected by the low status of women in the family and community, a poor understanding of complications and risk factors related to pregnancy and when medical intervention is needed, or by financial limitations, among others;

(ii) a delay in reaching care, which can be caused by: the distance to health centres and hospitals; the availability and cost of transportation; poor roads; and geography (mountainous terrain, rivers etc.); and

(iii) a delay in receiving adequate care due to poor facilities, lack of medical supplies, inadequately trained and poorly motivated medical staff, or inadequate referral systems.

The second framework is the "intermediate determinants model" (McCarthy and Maine, 1992). It starts with the recognition of the simple fact that a maternal death is the result of a sequence of two events, pregnancy and pregnancy-related complications. Before a woman's death can be considered a maternal death, she has to experience some complications related to pregnancy, childbirth or during the postnatal phase, but before experiencing any such complications she has to be pregnant. This sequence of three events (pregnancy, pregnancy-related complications, and maternal death) is directly influenced by a set of five intermediate determinants:

(i) the health status of the woman, which refers to conditions such as her nutritional status, infectious and parasitic diseases (such as malaria, hepatitis and tuberculosis), chronic conditions such as diabetes and hypertension, and prior history of pregnancy complications;

(ii) her reproductive status, including age, parity and marital status;

(iii) her access to health services, which refers to the location of services, range of services available, quality of care, and access to information about services;

(iv) her health care behaviour, including her capacity to utilize modern health services for family planning, prenatal care for labour and delivery, as well as her capacity to reject traditional harmful practices; and

(v) a set of unknown factors, which are related to maternal deaths but do not arise as a result of the previous four factors.

There is also a set of socioeconomic and cultural factors that influence these intermediate determinants. They are called "distant determinants" and affect maternal mortality through

the intermediate determinants. These factors relate to the woman´s status in the family and in the community (education, occupation, income, social and legal autonomy), her family's status in the community (family income, land, education and occupation), and her community status (aggregate wealth and community resources).

This latter framework has important implications for research since it clarifies the mechanisms through which social, behavioural and biological factors interact to produce an outcome (pregnancy, complication, death). Even more important are the implications for policies and programmes. This framework provides a context for the discussion of programmes to address maternal mortality by identifying and organizing, in a logical sequence, the main factors affecting maternal mortality. Moreover, it provides a model to estimate the relative importance of the various paths to reduce maternal mortality. As indicated above, pregnancy and pregnancy complications are part of the sequence of outcomes that culminate in maternal mortality. This sequence leads to three basic but relevant propositions. Any factor that is considered to reduce maternal mortality, and consequently, any effort to reduce maternal mortality, must operate through these outcomes. These efforts are:

(i)   reduce the probability that a woman becomes pregnant;
(ii)   reduce the probability that a pregnant woman experiences serious pregnancy or childbearing complications; and
(iii) improve the outcomes for women with complications.

In all studies and interventions, the way in which a given variable or activity is expected to ultimately influence one of the outcomes of the sequence should be made clear.

These two frameworks do not contradict each other; on the contrary, they complement each other. It is important to clarify that these two models are included in this thematic report not for the purpose of testing them, but to provide conceptual support to the interpretation of the data and analyses presented here, to assist in suggesting further research, and also to support discussions of the policy implications of the results obtained in this study.

Chapter 5. Maternal mortality by urban-rural place of residence and States/Regions

One of the advantages of census information is the availability of data to estimate indicators at the subnational level. In this chapter maternal mortality is estimated by urban-rural place of residence, and by the major administrative subdivision of Myanmar - the States and Regions.

The two frameworks presented in Chapter 4 clearly suggest why the maternal mortality level in rural areas (310) is higher than in urban areas (193), see Table 5.1 and Figure 5.1. It is very likely that the delays proposed in the first model are more prevalent in rural than in urban areas. Similarly, the distant determinants, operating through the four intermediate determinants proposed in the intermediate variable framework, are likely to affect maternal mortality differences between rural and urban areas. For example, the educational level of the population in rural areas is lower than in urban areas (Department of Population, 2015). Therefore, in rural areas a more limited understanding of pregnancy complications, particularly when medical interventions are necessary, may be expected[9].

Access to medical facilities in rural areas is likely to be more difficult than in urban areas because of distance, lack of transportation, difficult terrain or simply because facilities are not available at all. Finally, facilities in rural areas may be frequently understaffed, poorly equipped for emergencies and have limited medical supplies. It is well known that in most countries, health services, in particular, those able to provide emergency obstetric care, are concentrated in urban areas. The Fertility and Reproductive Health Survey (Department of Population and UNFPA, 2009) provides some related data. For example, in urban areas, the percentage of deliveries at home is 49 per cent, while in rural areas it is 85 per cent. Deliveries assisted by a doctor in urban areas are nearly five times higher than those in rural areas (43 per cent compared with 9 per cent). The percentage of deliveries assisted by a nurse/midwife is 49 per cent in rural areas and 39 per cent in urban areas[10]. Finally, 19.6 per cent of pregnant women did not receive any type of antenatal care in rural areas, while this percentage was only 6.5 per cent in urban areas.

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[9] According to the 2014 Census, the female illiterate population in rural areas is 16.2 per cent while in urban areas it is only 6.3 per cent. The female population 25 years and over with no or only primary education in rural areas is 77.7 per cent while in urban areas it is 42.2 per cent (Department of Population, 2015).
[10] Note that the MDG 5 of having at least 50 per cent of births attended by skilled health personnel has been achieved in Myanmar. At the Union level, 64 per cent of all births are attended by doctors or professional nurses/midwives. This percentage is 82 in urban areas and 58 in rural areas (WHO, 2009).

Table 5.1

Maternal mortality indicators, Union, urban-rural aggregates and States/Regions, 2014 Census

Area	MMRatio	MMRate	PMFD	LTR
Union	281.6	0.209	0.11	7.3
Urban	192.5	0.109	0.06	3.8
Rural	309.7	0.254	0.13	8.9
Kachin	269.7	0.250	0.11	8.8
Kayin-Kayah*	276.1	0.279	0.10	9.8
Chin	356.7	0.510	0.11	17.8
Sagaing	271.0	0.200	0.10	7.1
Tanintharyi	157.1	0.150	0.08	5.3
Bago	315.6	0.220	0.11	7.6
Magway	343.6	0.220	0.13	7.6
Mandalay	279.7	0.180	0.08	6.4
Mon	216.9	0.161	0.07	5.6
Rakhine	314.3	0.270	0.11	9.3
Yangon	213.3	0.120	0.06	4.3
Shan	278.3	0.266	0.11	9.3
Ayeyawady	353.7	0.304	0.09	10.6
Nay Pyi Taw	198.1	0.151	0.09	5.3

*Due to its small population and, therefore, its small number of recorded maternal deaths, the data for Kayah has been merged with that of Kayin.

Figure 5.1

Maternal mortality ratios, Union, urban-rural aggregates and States/Regions, 2014 Census
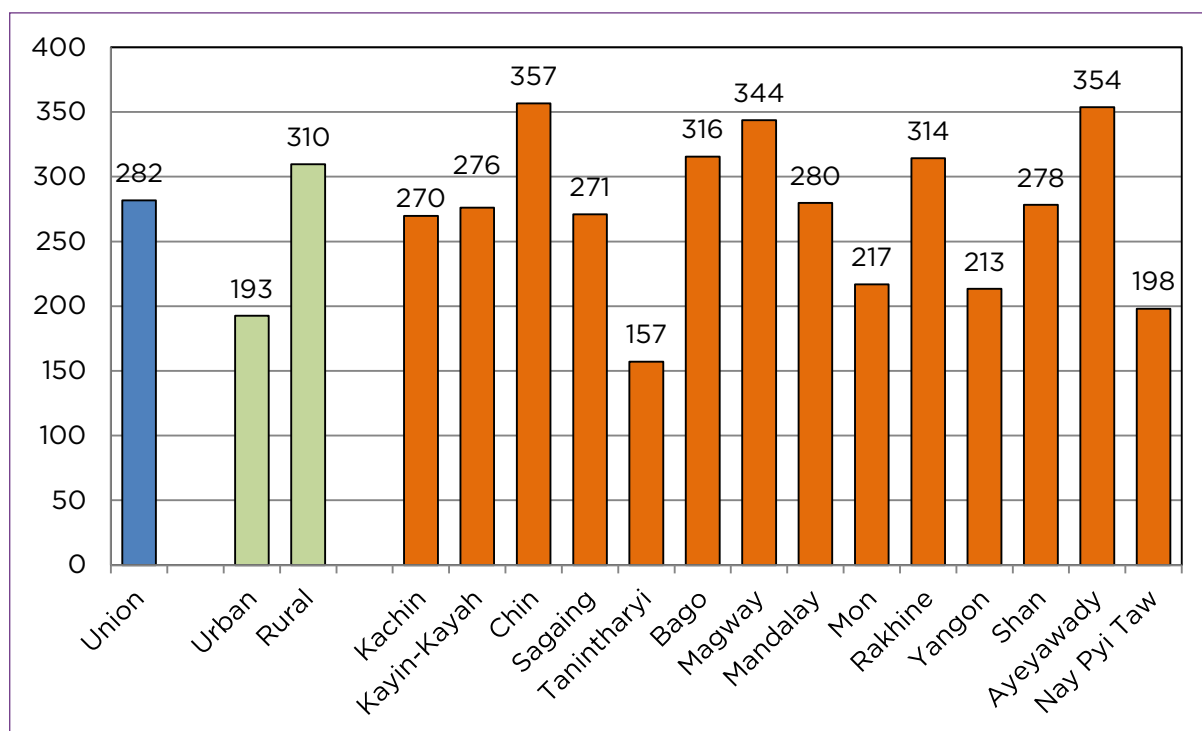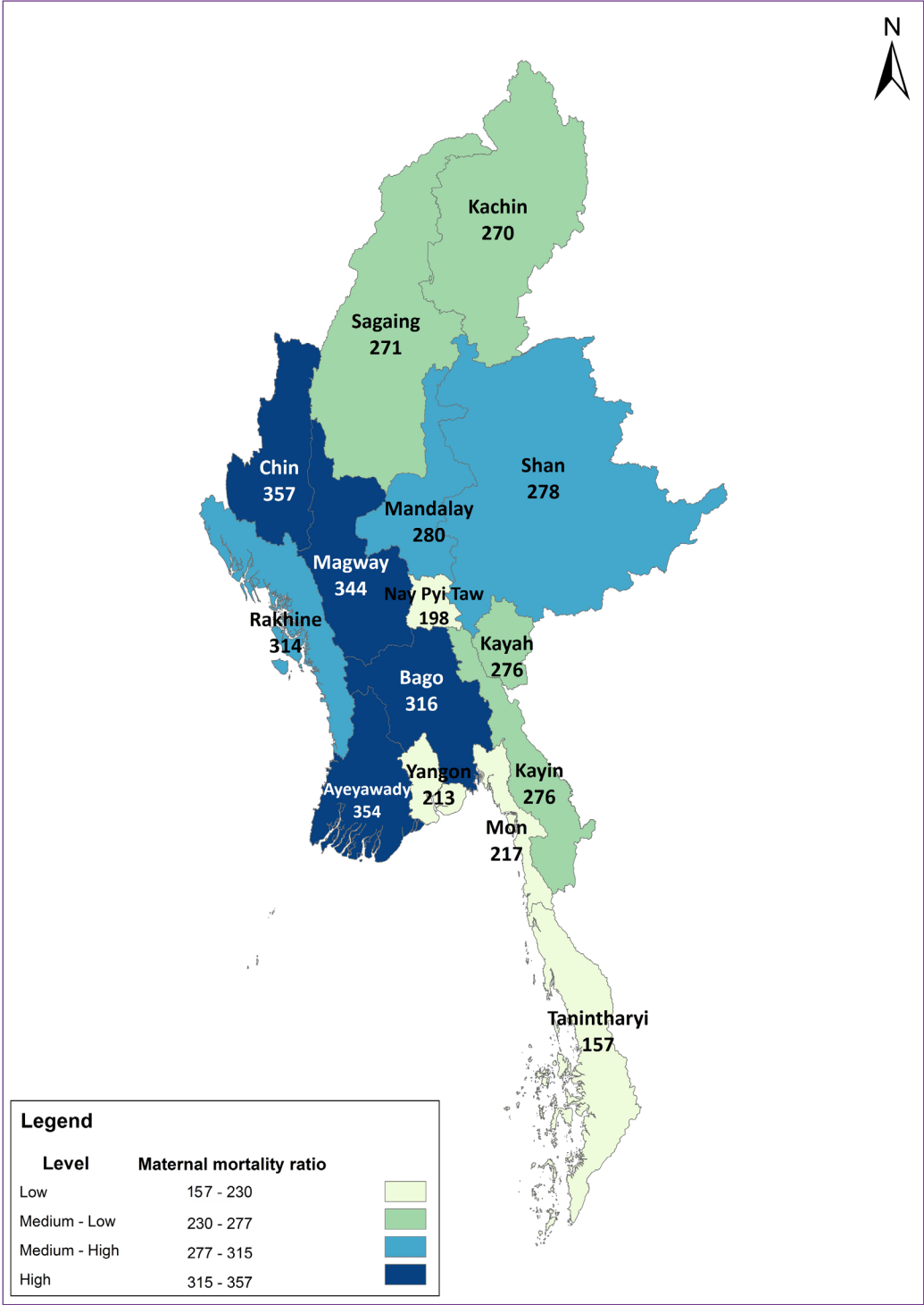
The statistics given in the previous paragraph mainly refer to indicators of the second delay (delay in reaching care). According to the intermediate variable framework, the three factors mentioned above are precisely the intermediate variables; access to health services and health care behaviour, which are, in turn, determined by the urban/rural character of the place of residence. It could be important to conduct studies to analyse empirically how most indicators of the three delays, or indicators of the four intermediate variables, are responsible for the higher maternal mortality levels in rural areas. An in-depth qualitative study appears to be appropriate for this sort of research. However, the 2014 Census data only provides a quantitative base for this proposed qualitative approach.

An important determinant of maternal mortality that is explicitly considered in the intermediate determinants model is fertility. High fertility levels are considered as a major determinant of maternal mortality mainly because in the context of high fertility, pregnancies may occur too early, too late or too frequently. This pattern increases the probability of illness during pregnancy and of complications at the time of birth. Table 3.2 shows how the MMRatio increases with age, reaching a figure of over 1,000 for the age group 45-49. At age 15-19 it is not as high as might be expected. Nevertheless, fertility in Myanmar is comparatively low. The total fertility rate (TFR) is 2.5 children per woman according to the 2014 Census (Department of Population, 2016b). Variations between urban and rural areas, and among States/Regions are minimal and it does not seem to substantially affect the observed maternal mortality differentials. There is one exception, however, that is discussed below.

Table 5.1, Figure 5.1 and Figure 5.2, show maternal mortality indicators by States/Regions[11]. There are substantial variations among the 15 States/Regions into which the country is divided. The highest level of maternal mortality in terms of MMRatio is 357 deaths per 100,000 live births (Chin), while the lowest level is 157 per 100,000 live births (Tanintharyi). There are five States/Regions with maternal mortality levels greater than the Union average - all with an MMRatio well over 300 maternal deaths per 100,000 live births. These are Chin State (357), Ayeyawady Region (354), Magway Region (344), Bago Region (316) and Rakhine State (314). At the other end of the scale, there are four States/Regions with levels of maternal mortality much lower than the Union average, namely: Mon State (217), Yangon Region (213), Nay Pyi Taw (198), and Tanintharyi Region (157). (For a reference map of Myanmar showing the State/Region and District boundaries see Figure 1).

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[11] Because of its small population and, therefore, its small number of recorded maternal deaths, the data for Kayah has been merged with that for Kayin.

Figure 5.2

Map of maternal mortality ratios* by State/Region, 2014 Census

Legend		
Level	**Maternal mortality ratio**	
Low	157 - 230	
Medium - Low	230 - 277	
Medium - High	277 - 315	
High	315 - 357	

* The map shows the spatial distribution according to four levels of maternal mortality (low, medium-low, medium-high and high). These levels are established by the three quartiles of the distribution (230, 277 and 315); these values divide the distribution in to four portions, each including 25 per cent of the cases.

Among the five States/Regions where the MMRatio is higher than the Union level, one State (Chin) stands out. This State, which has the highest maternal mortality ratio (357), has an atypically high fertility rate (TFR) of 5.0; this is significantly higher than the second highest maternal mortality ratio for Ayeyawady (354 - see Table 5.2). It is possible that the high level of maternal mortality observed in Chin State is related to the high fertility levels of its population. It is important to remember that in the intermediate determinants framework, one of these determinants is reproductive status, including, among others, age and parity – referring to pregnancies occurring among women who are either particularly young or particularly old, or who have too many children. Fertility rates in Chin are concentrated in the age groups 20-24 to 35-39. Fertility in the age group 15-19, as well as in the age groups 40-44 and 45-49, is quite low[12].

It would be possible to suggest that high maternal mortality may be affected by short birth intervals and not early or late pregnancies. Nevertheless, even in the age group 25-29 with the highest ASFR of 0.2544 there is an average of 1.3 births per woman (5 x 0.2544), which would be spaced on average 5/1.3 = 3.8 years apart. This is not a short birth interval, which usually, is considered as being less than two years. It could be important to conduct additional analyses to verify whether fertility has some role in the high maternal mortality in this State. In addition, the low levels and small fertility variations appear unlikely to affect maternal mortality differences among States/Regions to any great degree.

The three delays model (see Chapter 4) identified certain variables measured in the Census that can be used to explain the differences in maternal mortality levels between States/Regions. These are variables associated with the barriers that result in the delays proposed in this model. In the intermediate determinants model, these variables correspond mainly to the distant determinants. The Census does not provide direct indicators of these delays or determinants, but some proxy indicators, that is, variables that are not direct indicators of the delays but are likely to have a strong correlation with them, can be identified. Six variables for the States/Regions were selected:

(i) the percentage of illiterate females, which is likely to be associated with indicators of the first delay, such as the ability of women to identify pregnancy complications and the need for medical intervention;

(ii) the percentage of women with no education or with primary education only, which is also likely to be associated with the first delay for the same reasons as the variable above;

(iii) the percentage of households with electricity, which can be associated with the level of development of States/Regions and, therefore, to the second delay, which refers to the availability of health facilities, remoteness and transportation: it may also be associated with the third delay which refers to the quality of health services;

(iv) the percentage of households with a landline, mobile phone or internet access, which is also associated with the level of development and, therefore, to the

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[12] Age-specific fertility rates in Chin State are as follows:

15 - 19	20 - 24	25 - 29	30 - 34	35 – 39	40 – 44	45 – 49
0.0496	0.2048	0.2544	0.2350	0.1623	0.0759	0.0183

second and third delay;

(v) the percentage of households with a motorized vehicle (car, truck, van, motorcycle, moped, motor boat), which refers to availability of transport and is a direct indicator of a variable corresponding to the second delay; and,

(vi) fertility, which is very important in the intermediate determinants model as an outcome and as an intermediate variable.

Table 5.2 shows the set of indicators of State/Region characteristics discussed in the previous paragraph, as well as the respective MMRatios. It is not easy to grasp whether there are associations between each of the six indicators and the MMRatio. For this reason the Pearson correlation coefficients between each indicator and MMRatios were computed. This measure quantifies a linear relationship between two variables, that is, whether high values in one variable correspond to high (or low) values in the other variable[13]. An easier interpretation is provided by the "coefficient of determination", which is the squared correlation coefficient. Multiplied by 100, this coefficient indicates the percentage of variation in one variable that is explained by the variation in the other variable or, in other words, the variation in one variable associated with the variation in the other variable[14].

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[13] This coefficient varies between -1.0 and +1.0. A coefficient of -1.0 indicates a perfect inverse linear relationship, that is, too low values of one variable correspond only with high values of the other and vice versa. A coefficient of +1.0 signifies a perfect positive linear relationship, that is, too high values of one variable correspond only to high values of the other and vice versa. A relationship of 0.0 is a sign of an absence of relationship.

[14] It is important to clarify that correlation does not indicate a causal relationship. For example, it is not correct to conclude from a correlation that fertility is the cause of maternal mortality. Both variables are related in the sense that high levels of maternal mortality are associated with high fertility rates, but this connection cannot be interpreted as a causal relationship. In some cases it is possible to conclude that the association suggests a causal relation, but such a relationship has not been proved by the correlation. In addition, the results of an aggregate level regression analysis cannot be interpreted as relationships at the individual level. For example, areas with a large proportion of women with low fertility rates usually exhibit lower maternal mortality levels than areas with larger proportions of high fertility women. However, from this relationship it is not possible to conclude that women with low fertility rates are less likely to die from maternal deaths than women with high fertility rates. This is probably correct, but a relationship between two aggregate level variables does not necessarily imply that the relationship also takes place among individuals.

Table 5.2

Maternal mortality ratios and selected indicators of State/Region development, 2014 Census

State/Region	MMRatio	Percentage of females who are illiterate	Percentage of females with only primary or no education	Percentage of households with electricity	Percentage of household with access to communication means*	Percentage of households with motorized transport	Total fertility rate
Union	281.6	13.1	66.5	32.4	44.0	44.0	2.51
Kachin	269.7	12.5	56.0	30.3	48.3	76.5	3.04
Kayin-Kayah**	276.1	34.1	72.2	30.3	32.2	50.4	3.40
Chin	356.7	32.1	70.9	15.4	23.4	30.2	5.00
Sagaing	271.0	9.3	72.4	24.2	28.4	59.0	2.45
Tanintharyi	157.1	10.4	65.8	8.0	39.6	51.5	3.31
Bago	315.6	8.5	70.3	27.7	33.9	36.7	2.36
Magway	343.6	12.1	74.6	22.7	30.7	40.6	2.29
Mandalay	279.7	11.2	66.9	39.4	53.2	63.1	2.12
Mon	216.9	19.2	67.8	35.7	42.7	46.5	2.52
Rakhine	314.3	23.1	78.1	12.8	20.8	17.8	2.76
Yangon	213.3	6.4	42.6	69.3	88.3	22.4	1.85
Shan	278.3	48.2	77.1	33.4	43.2	68.8	3.07
Ayeyawady	353.7	8.5	71.4	12.0	25.9	25.9	2.81
Nay Pyi Taw	198.1	10.7	59.1	42.6	57.7	45.2	2.42
Correlation coefficient		0.21	0.54	-0.40	-0.61	-0.28	0.28
Coefficient of determination		4%	29%	16%	37%	8%	8%

* Includes landline phone, mobile phone or internet at home.

** Due to its small population and, therefore, its small number of recorded maternal deaths, the data for Kayah has been merged with that of Kayin.

The correlation coefficient and coefficient of determination corresponding to the relationship between the MMRatio and each indicator are shown at the bottom of Table 5.2. There are only two relationships that are worth exploring; the percentage of females with only primary or no education, and the percentage of households with access to communication means. The differences in the relationship between the other variables are quite low, indicating that the respective variable has a low capacity to explain variations in maternal mortality levels between States/Regions. In addition, only correlations corresponding to the two mentioned variables are statistically significant (5 per cent)[15].

These two variables explain important percentages in the variation of maternal mortality. The percentage of women with no education or only primary education among States/Regions explains 29 per cent of the variation in maternal mortality levels among States/Regions, while the percentage of households with access to communication means explains 37 per cent of the variation. The former indicator appears to be associated with first delay problems in the States/Regions, that is, the proportion of women unable to identify pregnancy-related

[15] Another feature of a correlation coefficient is its statistical significance. This concept refers to whether or not a correlation is the result of random factors. This depends on two aspects: the magnitude of the correlation and the sample size or number of cases. A low coefficient might be significant if the number of cases is large, but a comparatively high coefficient might not be significant if the number of cases is small. Statistical significance is tested by using probabilistic distributions that indicate the probability at which a correlation is significant considering its level and number of cases. For example a given correlation may be significant at a 5 per cent level. This means that there is a 5 per cent chance that the coefficient is the result of random factors. Usually, the limit to accept a correlation as significant is 1 per cent or 5 per cent.

complications and the need for medical intervention. In the intermediate determinants model, it corresponds to a distant determinant, in particular, to the women's status in the family and in the community, which includes women's education as an indicator. The latter indicator does not appear to refer solely to the communication capacity of the population, but mainly to remoteness and development issues. States/Regions with a lower proportion of their population with access to communication means probably contain large under-developed and remote areas where problems associated to the second and third delay are frequent. In the intermediate determinants framework it also corresponds to a distant determinant, but in this case it seems to refer to a community's status.

These two variables are not exact predictors, in the sense that a percentage change in one is not related to an exact MMRatio increase or decrease. These relationships merely indicate a general linear trend that high percentages tend to be associated with high, or low, ratios, and that there are some exceptions. Figure 5.3.1 shows the plot of MMRatios against the percentage of women with no or with only primary education among the States/Regions, and Figure 5.3.2 the plot of MMRatios against the percentage of households with means of communication. The dots representing each pair of values do not form a straight line; they follow a general trend around a straight line. Nevertheless, some points may be well out of the general linear trend. In Figure 5.3.1 there is one point that is clearly out of the trend. It corresponds to Tanintharyi (red dot), where the MMRatio should be higher considering its high percentage of women with only primary or no education (157; 65.8 per cent). In Figure 5.3.2, Tanintharyi is again well out of the linear trend (red dot). In this case, its level of maternal mortality should be higher considering its low percentage of households with means of communication (157; 39.6 per cent). There are other points that are somewhat out of the linear trend, but their distance is not as large as the case of Tanintharyi. However, as indicated above, only a general linear trend is expected.

Figure 5.3.1

Maternal mortality ratios according to percentage of females with no or only primary education, 2014 Census
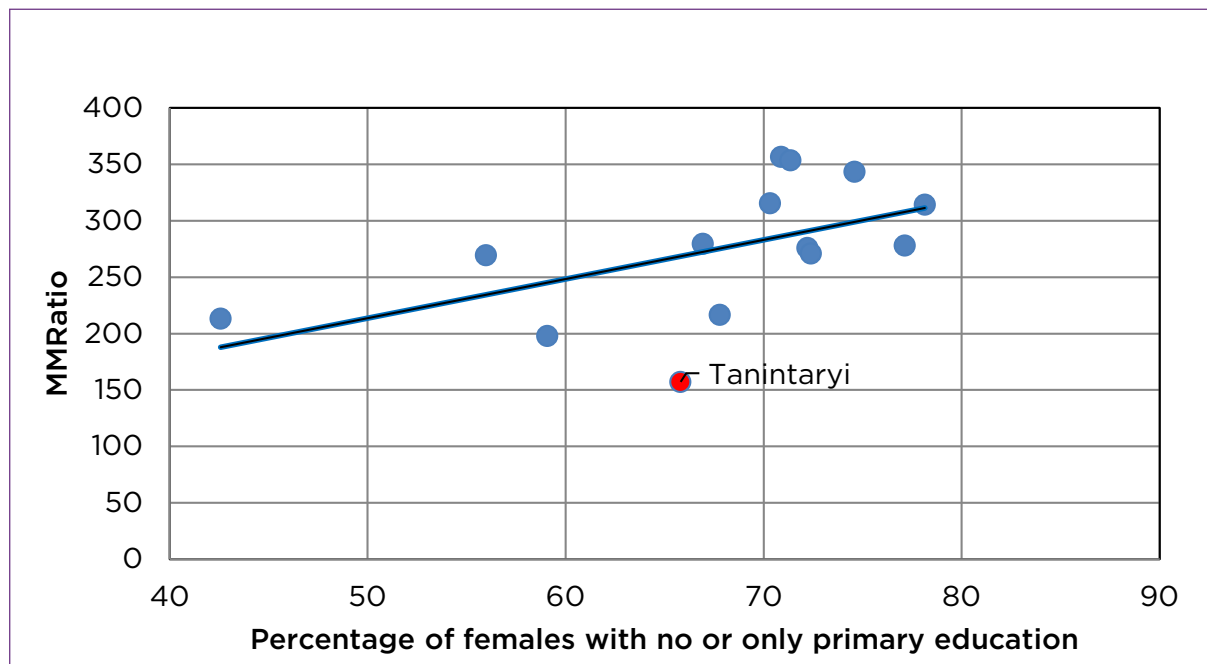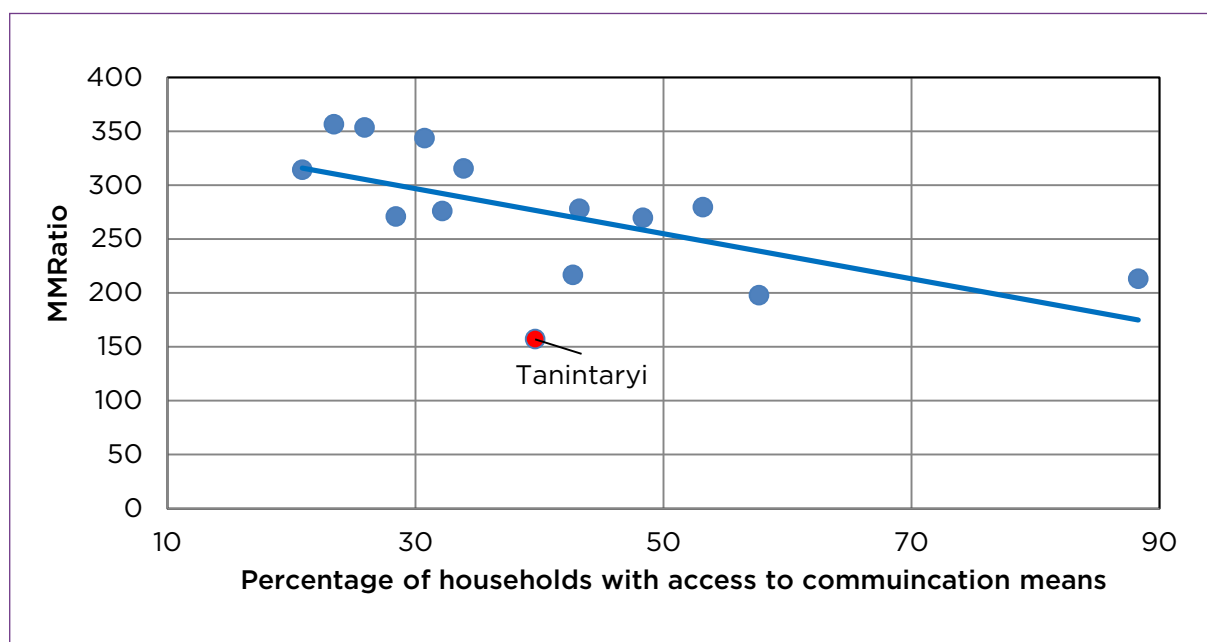

Figure 5.3.2

Maternal mortality ratios according to percentage of households with access to communication means*, 2014 Census

* Includes landline phone, mobile phone or internet at home.

It is important to analyse why Tanintharyi is so far from the linear trend. In addition to the other variables presented in Table 5.2, the degree of development of this Region is not very high. For example, it is the Region with the lowest percentage of households with access to electricity (8.0 per cent) (Department of Population, 2015). The level of maternal mortality in Tanintharyi is rather low compared to other States and Regions considering its degree of development. An in-depth qualitative analysis would be necessary to analyse this occurrence, but the 2014 Census information is not sufficient and adequate for a study of this type[16]. For a more in-depth analysis it would be particularly appropriate to use the intermediate determinants framework including not only the distant, but also the intermediate determinants. This analysis should be conducted both at the aggregate and individual levels.

It is also interesting to discuss the other variables considered in Table 5.2. In fact, all these other variables exhibit some correlation, but they are not statistically significant, which means that the relationship could be the result of random factors. What is surprising is the non-significant correlation between the percentage of households with motorized transport and the MMRatio. This variable can be considered as a direct indicator of the second delay in the three delays framework, since one of the barriers for women to gain access to basic obstetric and emergency care facilities is a lack of transportation. Therefore, it may be expected that States/Regions with a high percentage of households with means of transportation have lower levels of maternal mortality - however, this is not the case. This result does not mean that the availability of transportation is not a relevant variable in the analysis of maternal mortality; it means that at the aggregate level, when States/Regions are the units, it does not affect maternal mortality. This issue is discussed further in the next chapter.

A final analysis was conducted with additional data in order to gain further insights into the maternal mortality spatial distribution. Three indicators of availability of health services in the 15 States/Regions were considered: (i) number of nurses, (ii) number of midwives and, (iii) number of hospital beds (all indicators expressed per 100,000 inhabitants). These indicators were obtained from the 2010 report on Myanmar health statistics (Ministry of Health, 2010). Correlation coefficients were computed between each indicator and the MMRatio. The resulting coefficients were 0.27, 0.34 and 0.09, respectively. None of these are statistically significant, even with a 10 per cent error[17].

This lack of relationship may have two interpretations. On one hand, the uneven distribution of maternal mortality levels among States/Regions is not being affected by the spatial distribution of health services. On the other hand, the government health policy, which would increase health services in those areas with a more vulnerable population, may not yet have had the expected results in terms of reducing inequalities. Consider the example of Chin; it is the State with the highest number of nurses (160 per 100,000 population compared with 28 at the Union level), midwives (89 per 100,000 population compared with 23 at the Union level) and hospital beds (183 per 100,000 population compared with 67 at the Union level), yet its MMRatio is still the highest in the country, (357 maternal deaths per 100,000

[16] The data previously presented from the 2007 Fertility and Reproductive Health Survey on the availability of maternal health care is not available for individual States/Regions. Because of sample size issues Regions/States were grouped into domains. Tanintharyi was combined with Kayin and Mon.
[17] It is important to point out that it was decided to keep this analysis simple and basic since its purpose is to suggest further studies on maternal mortality that combine census data with information from other sources. For this reason a table is not included.

live births). Conversely, Mon has the smallest number of nurses (10 per 100,000 population), the second smallest number of midwives (17 per 100,000 population) and also the lowest number of hospital beds (34 per 100,000 population), yet, it has a MMRatio well below the Union average (217 against 282). Tanintharyi, already identified as a special case because of its low maternal mortality level in spite of its position in development indicators, is also an interesting case. In spite of exhibiting the lowest MMRatio, its position regarding the indicators of health service availability is below the Union average; it has only 22 nurses, 22 midwives and 63 beds per 100,000 population, respectively.

This brief and basic analysis suggests the need for further studies, especially in light of the two frameworks already discussed in Chapter 4. Firstly, in spite of physical access it could be possible that many women, because of their low educational level, have a poor understanding of risks associated with pregnancy and when medical intervention is necessary. Cultural factors that affect the status of women in the community and family may also play an important role. Physical accessibility is irrelevant if decision makers within the family/community prevent actual accessibility to health care. Secondly, the concentration of services within each State/ Region (usually in urban areas) may prevent real access to health care for many women who live in less developed areas, especially if geography (mountainous terrain, rivers, etc.) is harsh and travel problematical. Thirdly, deficient facilities, lack of medical supplies and, in general, poor quality of services provided may also be important barriers to care.

The examination of these issues may help to elucidate why the spatial distribution of health resources is not related to the unequal distribution of maternal mortality. It is relevant to note that in the 2014-2018 *Five-Year Strategic Plan for Reproductive Health* for Myanmar, the Government acknowledges the importance of research that may help to understand the social and cultural determinants of utilization of maternal health services among various ethnic, social and economic groups (Department of Health, 2014).
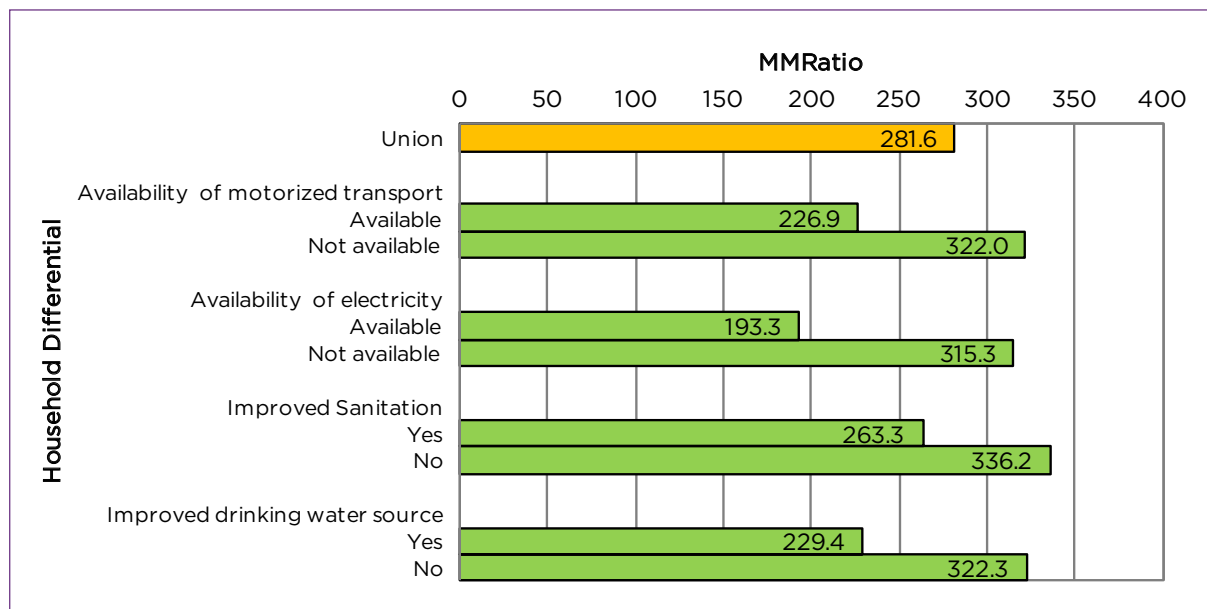
Chapter 6. Selected maternal mortality differentials

Maternal mortality differences between countries are a clear reminder that economic, social and cultural features of societies have a major effect on human well-being. As noted in Chapter 1, maternal mortality has been identified as the health indicator with the largest disparity between the developed and the developing countries. Countries vary considerably in their provision of delivery facilities with services for basic and emergency obstetric care, and removing barriers that prevent women from accessing these services. In addition, the health of people depends on infrastructure developments such as clean water, improved sanitation, good communication systems and transportation networks for food delivery. However, within the same country some people are more disadvantaged than others in these respects, or, in other words, resources that affect people's health can be distributed in a quite unequal way (Weeks, 2005). Mortality differences within countries are usually called mortality differentials. Such differentials between urban and rural areas and States/Regions were discussed in the previous chapter. In this chapter some differentials are examined in respect of variables that form or define categories of women that are likely to exhibit different maternal mortality levels. Unfortunately, such variables are quite limited because the 2014 Census only collected information on the age and sex of deceased persons in the household. Therefore, differentials were derived from some selected characteristics of the household in which the deceased women lived.

Figure 6.1 shows selected differentials that reflect the unequal levels of access to health services and economic and social disadvantage. It is quite clear that all of them are related to maternal mortality. The first variable shown in the Figure is whether or not the household of the deceased woman reporting had motorized transport (car, truck, van, motorcycle, moped, motor boat). The MMRatio in households that own a motorized vehicle is 227 deaths per 100,000 live births, while in households that do not, the ratio is 322 deaths per 100,000 live births. It is important to remember that no relationship between ownership of motor vehicles and maternal mortality was found at the aggregate levels, when the analysis was undertaken with occurrences of maternal mortality among States/Regions. As pointed out earlier, an aggregate correlation, or the lack of it, does not necessarily indicate that the respective variables are also related, or not related, at the individual level. Explaining this outcome requires a long methodological account that is far from the objectives of this report: however, it is important to remember that availability of transport is one of the barriers to women´s access to basic and emergency obstetric care (second delay) and this differential is therefore not surprising.

Figure 6.1

Maternal mortality differentials (MMRatio) for selected housing variables, 2014 Census

The three other variables used to define maternal mortality differentials in Figure 6.1 show the expected results. Households with access to electricity, improved sanitation facilities and improved sources of drinking water all exhibit lower levels of maternal mortality than households without access to these facilities. These variables have a direct effect on maternal mortality, in particular those that are indicators of the levels of household hygiene. However, they are also related to maternal mortality because they are indicators of diverse vulnerabilities and levels of economic and social disadvantage which, in turn, are associated with the barriers in the three delays model. In particular, poorer women are less likely to access the level of maternal health care that they may need because they have less economic resources, are more likely to live in remote and isolated areas, have less access to quality health care, and have educational levels that limit their capacity to recognize and seek attention for maternal health complications.

Chapter 7. Policy implications

Many policies for maternal mortality reduction are available in respective literature (see, for example, Maine, 1991; USAID, 2015). It is not necessary to repeat them here. Only policy implications derived directly from the 2014 Census results obtained in this study are discussed in this chapter.

High fertility levels are a suitable starting point. As outlined in Chapter 4, the intermediate determinants model states that pregnancy and pregnancy complications are preconditions to maternal mortality. These two preconditions depend, in turn, among others, on the intermediate determinants of reproductive status, especially age and parity. Pregnancies occurring very early, very late or too frequently are major determinants of pregnancy complications. There is little doubt that high fertility rates have an impact on maternal mortality because, as already indicated, high maternal mortality occurs among the youngest, the oldest or when there is little interval between births. The intermediate determinants model proposes that one of the three major policy efforts toward maternal mortality reduction is to reduce the probability that a woman becomes pregnant. Hence, family planning programmes are usually recommended as a suitable intervention to reduce maternal mortality (USAID, 2015; USAID, WHO and UNFPA, 2010).

In the case of Myanmar, however, fertility appears too low to expect that further declines may substantially improve maternal mortality. Nevertheless, a further decline may still help to do so. A simple simulation helps to support this argument. If it is assumed that women aged 15-19, 40-44 and 45-49 (who are all high-risk women) do not have any children, they are not at risk of maternal deaths at all. If birth and maternal deaths are assumed to be zero in these three age groups, the MMRatio would be 254 instead of 282 deaths per 100,000 live births. In absolute terms, the decline would be from 2,797 to 2,163 maternal deaths. The difference would be 634 maternal deaths, which indicates that reducing fertility in these high-risk age groups is likely to reduce maternal mortality by 23 per cent.

The second issue is that fertility in some States/Regions is still high, Chin being the most extreme example with a TFR of 5.0 children per woman. In other States/Regions the TFR is not as high but it is high enough to somewhat influence maternal mortality. The States/Regions Kayah (3.5), Kayin (3.4), Tanintharyi (3.3) and Shan (3.1) are examples of this (Department of Population, 2016b). Improvements in family planning and reproductive health programmes may in turn improve maternal mortality in States/Regions with high fertility levels.

A very basic, but relevant result, is that maternal mortality is not evenly distributed across the country. As noted in Chapter 5 rural areas exhibit higher levels of maternal mortality than urban areas, and levels fluctuate substantially among States/Regions. For example, the MMRatio varies from 357 (Chin) to 157 (Tanintharyi) maternal deaths per 100,000 live births. If it is accepted that the availability of facilities for essential as well as emergency obstetric care is a major determinant of maternal mortality, and that such facilities are unequally distributed between rural and urban areas and among States/Regions, then an expansion of the number of facilities, and providing a more even distribution of these facilities across the Union might seem to be the right policy. However, as this report indicates, this does not seem to be the case. The WHO recommends that all subnational areas should have at least five emergency obstetric care facilities for every 500,000 population (WHO, UNFPA, UNICEF

and AMDD, 2009). Even if this recommendation is met, maternal mortality is still likely to remain high.

Three indicators of availability of health services by States/Regions were analysed: the numbers of nurses, midwives and hospital beds per 100,000 population. No relationship was found between any of these variables and maternal mortality levels in the States/Regions. This means that those States/Regions with a high (or low) position on these indictors do not necessarily have a high (or low) position in maternal mortality levels. This result has important policy implications. It seems that the material availability of health services is not enough to assure low mortality levels. Problems of physical and social accessibility (the isolation of some communities and limited education of their population), and poor quality social services are also important. Investments in these areas are of most relevance and urgency. In other words, policies should be directed to eliminate the barriers raised by the three delays (delay in the decision to seek care, delay in reaching care and delay in receiving adequate care – see Chapter 4). Using different terms and concepts, these delays are acknowledged by the Government as major barriers to maternal health (Department of Health, 2014). Using the vocabulary of the intermediate determinants model, efforts should be directed to improve health care behaviour and the use of health services mainly among women in disadvantaged positions in their families and communities, who are part of poor and deprived families, and who live in isolated and under-privileged communities. In practical terms, this can be achieved by reducing the likelihood of pregnant women in socially disadvantaged positions experiencing severe complications in pregnancy or childbearing and by improving the outcomes when complications occur.

The analysis of the differentials indicates that important inequalities in maternal mortality levels exist not only in respect of where women live, but also in how they live. Maternal mortality levels are higher among women who live in households without motorized transport, with no electricity, with unimproved sanitation facilities and unimproved sources of drinking water. These differentials confirm the results of previous studies since they are indicators of barriers to access health care services. In addition, they are also indicators of the standard of living of households. The main implication of these results is that the physical availability of health services alone is not enough to overcome the barriers to accessing health care. There are also economic, social and cultural obstacles. Hence, policies directed at reducing maternal mortality should also consider these factors. As suggested above, policies should be directed mainly at the poor, uneducated and women of low status, who live in deprived communities. These policies should aim to increase these women's access to antenatal and emergency obstetric care.

A final policy issue refers to the timing of maternal deaths. Traditionally, resources for maternal health care are concentrated in antenatal and delivery care. Investments in postnatal care usually receive less attention. Yet, maternal deaths during the postnatal period are the highest among the three phases. As noted in Chapter 3, maternal deaths that occur during the six weeks after delivery account for 38.5 per cent of all maternal deaths. Those maternal deaths that take place during delivery and before delivery account respectively for 32.4 per cent and 29.1 per cent of all maternal deaths. It is not suggested that antenatal care should receive less resources, but that postnatal care should not be left aside in the allocation of

resources to improve maternal mortality. It is estimated that about 50 per cent of maternal deaths in the less developed countries occur during the six-week period after childbirth (Institute for Health Metrics and Evaluation, 2015).

Most of these deaths, caused by sepsis, haemorrhage, hypertensive disorders and other treatable conditions, are preventable. In addition, care during this period can reduce the mortality risks for neonates as well. The previously mentioned 2014-2018 *Five-Year Strategic Plan for Reproductive Health* for Myanmar (Department of Health, 2014) recognizes the importance of postnatal mortality. However, the emphasis in the plan is on antenatal and delivery care. It is essential that maternal mortality during the postnatal phase receives much more attention. A simple exercise shows the importance of an effort of this type. If, for example, postnatal maternal mortality was to be reduced by two thirds, all other things being equal, the MMRatio would decline from 281.6 to 209.2 deaths per 100,000 live births. Although only a supposition, this exercise suggests the potential impact of postnatal mortality on the MMRatio. It is also relevant to propose that future reproductive health household surveys collect data on postnatal care. Until now, the emphasis has been on antenatal care and care during delivery.

To summarize, the results discussed in this section indicate the need for the following policy interventions:

(a) Continue and improve family planning efforts, especially targeting the young and the older population.

(b) Develop solutions for improving physical and social access of disadvantaged women to health services, especially in under-developed and remote areas. The results presented here indicate that maternal health care is not reaching all the population that it should; women with limited education, low socioeconomic status and living in poor communities are more likely to be marginalized from maternal health care (in addition to probably having a lower health status).

(c) More attention should be given to women's postnatal care, the stage when most maternal deaths take place.

These three suggested interventions are consistent with the more general policy efforts proposed by the intermediate determinants framework: reduce the likelihood that a woman will become pregnant; that a pregnant woman will develop a serious complication during pregnancy or childbearing; and improve the outcome for women who develop complications.

It is important to remember that these three policy interventions are derived exclusively from the main results of the analyses of the 2014 Census data. Because of the type of data collected in the Census, these analyses are necessarily limited and, as a consequence, it is not possible to propose an exhaustive list of policy interventions. As noted above, an extensive list of policy interventions is available in the respective literature. However, a discussion of general policy interventions is beyond the objectives of this present report.

The few analyses and interpretations presented here propose further research. A summary of research concepts derived from the analyses conducted here and relevant for policy interventions are presented as follows:

(a) The identification of indicators, at the individual level, that prevent women seeking and reaching basic and emergency obstetric care, as well as maintaining good health before, during and after pregnancy. The results of this study strongly suggest that socioeconomic variables are extremely relevant. Conducting studies in this area should involve data collection efforts using surveys and, especially, qualitative approaches.

(b) The identification of aggregate and spatial indicators that prevent women from receiving adequate primary and emergency obstetric care. The analyses conducted here suggest that under-development and the socioeconomic status of the community are important factors. Studies in this area of research could start by re-applying the correlation analysis conducted here, but using information from Government sources including, but not limited to, the availability of hospitals and health care centres, schools, connectivity to communication devices, road networks, and community centres. At the second stage, in-depth field studies would be appropriate.

(c) The role of fertility in maternal mortality. In spite of a substantial decline in fertility in Myanmar, fertility may still continue to affect maternal mortality. It is still high in some States/Regions and among women who are starting and ending their reproductive life. Particularly striking was the extremely high obstetric risks for women aged 35 and over, and especially those aged 45 to 49.

(d) A final proposed area for research is the analysis of postnatal mortality. As shown in Table 3.3 the largest percentage of maternal deaths in Myanmar take place six weeks after delivery (38.5 per cent). Research on this topic should identify the main immediate, intermediate and distant determinants. Especially appropriate would be a qualitative in-depth study, in particular, a verbal autopsy approach[18].

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[18] Verbal autopsy is a method used to determine the cause of a death based on an interview with relatives or other caregivers. This is done using a standardized questionnaire that obtains information on signs, symptoms, medical history and circumstances prior to death. The cause of death, or the succession of causes that led to death, are assigned based on the data collected by a questionnaire and any other available information. This method is particularly useful where most people die at home without having had contact with the health system. Although it is designed mainly to identify the cause of death, it is also used to collect other information of the deceased (WHO, 2012).

Chapter 8. Conclusions

In spite of the under-enumeration problems experienced in some parts of the country in the 2014 Census of Myanmar (Department of Population, 2015), the Census data provides reliable estimates of maternal mortality in all cases. The development of methods that allow for evaluation and adjustment of data has been of crucial importance in this respect. The indicators of maternal mortality levels presented here may be estimates, but are accurate enough to be used in policymaking and public health planning. This is the case in regard to national level measures, urban-rural areas, States/Regions, and according to selected differentials.

It is important to recognize that this is a very basic study of maternal mortality, conducted primarily to make basic indicators and preliminary analyses available. However, it also makes recommendations for further research. It has been proposed that the most critical research topics on safe motherhood are studies of the barriers that women experience to reach health care. As detailed in this report, health services can be physically available, but there are delays that prevent women from actually accessing health care, in particular emergency care. Census data are generally insufficient to study these issues. Health statistics, survey studies, and qualitative research are more appropriate. However, the 2014 Census data may provide a quantitative overall basis for these more detailed studies. The importance of this type of research is also recognized in the 2014-1018 *Five-Year Strategic Plan for Reproductive Health* (Department of Health, 2014).

A final issue is the importance of using theoretical frameworks or models to analyse the data. For this report two models were used, the three delays framework and the intermediate determinants framework. In spite of being a primarily quantitative study, with limited scope and very basic statistical analyses, the use of theoretical models helped not only to provide sound interpretations of results, but also potential ideas for research and surveys that could be undertaken in the future.

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Glossary of terms and definitions

Age-specific fertility rate: the number of live births divided by the female population for each five-year age group within reproductive age (conventionally, from 15-49 years).

Brass Growth Balance Equation: a method to assess the completeness of deaths recorded in a census from the question on the number of deaths in a household during the preceding 12 months. It is based on the mathematical relationship between the age distribution of deaths and the age distribution of the population.

Brass P/F ratio: P/F ratio is a method formulated by William Brass, where data on children ever born and the number of women in reproductive age data are used to adjust for under-reporting or over-reporting of the number of births reported to have occurred during a year prior to a survey or census. For a complete description of this method see United Nations, 1983.

Crude death rate: the number of deaths that took place in a given year divided by the population in the middle of that year. It is usually multiplied by 1,000.

General fertility rate: the total number of live births per 1,000 women of reproductive age (15-49) in a population per year.

Infant mortality rate: the number of deaths of infants aged under one year per 1,000 live births.

Life expectancy at birth: the average number of years that a newborn baby is expected to live if the mortality conditions of the year corresponding to the life table remain constant.

Lifetime risk of maternal death: The chance of a woman dying from maternal causes over the course of her 35-year reproductive lifespan; it is calculated by multiplying the MMRate by 35.

Maternal death: the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

Maternal mortality rate: the number of maternal deaths divided by the number of women aged 15-49 multiplied by 1,000.

Maternal mortality ratio: the number of maternal deaths divided by the number of live births, multiplied by 100,000.

Pregnancy-related death: the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

Proportion of Adult Female Deaths due to Maternal Causes: the number of maternal deaths divided by the number of deaths among women aged 15-49.

Total fertility rate: the average number of births that women will have at the end of their reproductive life if the present level and age structure of fertility remains constant in the future. It is the sum of the seven age-specific fertility rates multiplied by five.

Under-five mortality rate: the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before reaching the age of five if subject to current age-specific mortality rates.

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Thematic Report on Maternal Mortality
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