LIST OF TABLES

LIST OF FIGURES

1. Introduction

1.1 Background

Over 130 million babies are born every year worldwide, and more than 10 million infants die before their fifth birthday, almost 8 million before their first anniversary (WHO, 2006).

Many countries have set under-five mortality reduction as their key development goal, as suggested by international conferences such as the World Summit for Children in 1990, the United Nations Millennium Declaration and the United Nations Special Session on Children in 2002 (WHO, 2006). In preparing child-mortality reduction strategies it is important for countries to know the magnitude of perinatal and postperinatal mortality including risk of death in childhood in order to assess needs and develop programmes that will reduce avoidable child deaths more quickly.

In studying perinatal mortality in Kazakhstan there is almost no any scientific research observed and examined by demographic, social or medical scientists. Many scientific studies which were ever conducted in Kazakhstan describe and analyse the trends on under-five and infant mortality rates. Kazakhstan also has set under-five mortality reduction as his key development goal (UN, 2005).

It's essential to note that the reduction of child, infant and perinatal mortality rates starting from the level of potential health capital at birth, which can be roughly estimated through indicators such as birth weight, gestational age, or the presence of a congenital handicap, an infant's capacity to maintain or restore this potential, if necessary, depends on a whole series of factors on which the newborn has almost no means of action. These are referred to by demographers and epidemiologists as determinants of perinatal, neonatal and infant deaths. Risk factor categories frequently employed include the demographic, socioeconomic, cultural, behavioral, and biomedical. But, the impact of each factor is not in the same level in different stages of infant and child life. If, the reduction of child and postperinatal mortality in most societies is explained by the improvements in socio-economic conditions where perinatal technologies have lesser impact, then early neonatal deaths and stillbirths stem from poor maternal health, inadequate care during pregnancy, inappropriate management of complications during pregnancy and lack of newborn care.

Some perinatal conditions are almost invariably fatal, whereas others are more easily managed. Therefore, an assessment of avoidability of deaths may help identify the areas most likely to succeed in preventing these deaths and may also give an indication of the performance of the health system and the health-seeking behavior in the area. It has been suggested that the reduction of perinatal mortality rate in high-income countries was due to the new perinatal technologies, special care towards risk pregnancies particularly introduced in the second half of the 20th century, Studies on perinatal mortality in the 19th century suggest that the introduction of midwifery-assisted deliveries was instrumental in reducing the perinatal mortality rate (Andersson et al., 2000), but more so for reducing maternal mortality (Loudon, 2000). In addition, simple improvements of hospital routines (Van Roosmalen, 1989) and perinatal audits (Ward et al., 1995) have been shown to reduce perinatal mortality.

As was previously said in studying perinatal mortality in Kazakhstan there are scarce, almost no any scientific research. Estimations related to perinatal deaths can be taken from infant and child mortality surveys conducted in Kazakhstan. In this field it is essential to note following surveys which were conducted in Kazakhstan:

- Demographic and Health Surveys in 1995 and 1999;
- The UNICEF-supported Analysis of Causes of Infant and Child Mortality in 2000

The Kazakhstan Demographic and Health Survey (KDHS) is part of the worldwide Demographic and Health Surveys (DHS) program, which is designed to collect data on fertility, family planning and maternal and child health. It was implemented by the Academy of Preventive Medicine of Kazakhstan, with funding provided by the U.S. One of the main objectives of the 1995 and 1999 Kazakhstan Demographic and Health Surveys were to document current levels and trends in infant and child mortality.

The 1999 KDHS questionnaire included a reproductive history in which questions were asked about each of a woman's pregnancies. Respondents were asked to report their pregnancy outcomes in terms of standard international definitions (WHO, 1993). *Live birth* was defined as any birth, irrespective of the duration of pregnancy that, after separation of the infant from the mother, showed any signs of life such as breathing, beating of the heart, or movement of voluntary muscles. *Infant death* was defined as the death of a live-born child less than one year of age.

The main objectives of the UNICEF-supported Analysis of Causes of Infant and Child Mortality in Kazakhstan was to find out the causes of death and also to document during which period, in which regions and in what types of healthcare institutions children died most often.

1.2 Research goal and objectives

For analyzing situation on perinatal mortality in Kazakhstan as theoretical frameworks have been taken demographic and social characteristics of childbearing population from various European infant and perinatal mortality studies where the effect of these factors have been estimated in different levels.

Fetal, perinatal and neonatal mortality rates are widely used as indicators for cross country comparisons of health status and quality of obstetric and neonatal care (Richardus et al., 1998). In Europe, there are substantial variations in these rates. EUROSTAT reported ranges from 2.7 to 9.3 ‰ late fetal deaths per1000 births and 1.5 to 8.5 neonatal deaths per 1000 live births for members of the EU25 in 2005 (EUROSTAT, 2009). Whether the variation in these indicators reflects differences in quality of care has been questioned, however. Differences in registration practices such as variable lower registration limits for gestational age and birth weight and in policies and practices of screening for congenital anomalies all have an impact on calculated perinatal mortality rates (Anthony et al., 2001). Yet the variations in mortality rates persist even when these differences are taken into account, as shown in the European studies EUROPERISTAT and EURONATAL (Buitendijk et al., 2003).

Variations in perinatal mortality may also result from differences in the demographic characteristics of the childbearing population. The literature shows that older mothers and primiparae both face increased risks of stillbirth (Canterino et al., 1994). Studies report higher rates of antepartum, intrapartum and neonatal complications such as pregnancy-induced hypertension, preterm labour, caesarean deliveries and neonatal intensive care unit admissions in older women (Berkowitz et al., 1990). Other studies conclude that primiparity is an independent risk factor for low birth weight (< 2500 g) and growth restriction (Cnattingius et al., 1993). Stillbirth, preterm delivery and transfer to a neonatal intensive care unit have been found to be more common among infants of primiparae (Huang et al., 2000). Multiple pregnancies are also known to carry a much higher fetal and neonatal mortality rate than singleton pregnancies, owing primarily to the higher preterm birth rate in multiple pregnancies (Annanth et al., 2005). The multiple pregnancy rates is also related to maternal age, both through a higher rate of spontaneous multiple birth among older women and because of the use of ovarian stimulants and assisted conception among older mothers. The differences in the prevalence of these risk factors may thus partly explain the inter-country differences in mortality rates and be unrelated to quality of care.

The EURO-PERISTAT project documented significant variations between the childbearing populations in Europe with respect to age, parity and multiple pregnancies in its study on data from the year 2000 (Breart et al., 2003). It also documented significant differences in fetal and neonatal mortality rates. These differences can spark extensive debate about the quality of the health care system. For instance, in the Netherlands, where perinatal mortality was shown to be the highest of all EU member states, (Buitendijk et al., 2003) heated discussion about the safety of the Dutch system, in particular the home birth option ensued. Among other explanations, however, were the facts that Dutch women have a relatively higher age at childbirth, more multiple pregnancies and fewer children and hence, a larger chance of being primiparous.

This study is concerned with the relationship between perinatal mortality and factors as: sex of a child, place of residence, mother's age, and marital status, and infant birth order.

The goal of the thesis is to identify the role of social and demographic determinants of perinatal mortality in Kazakhstan and to assess the usefulness of these determinants for reduction of perinatal deaths.

To achieve this purpose it is necessary to consider following objectives:

1) To analyse perinatal mortality in Kazakhstan by demographic factors:
   a) mother's age;
   b) sex of child;
   c) child's birth order
2) To analyse perinatal mortality in Kazakhstan by social factors:
   a) place of residence of mother;
   b) marital status of mother;

Thus, this thesis deals with the underlying factors of perinatal mortality. The association between each factor and perinatal mortality was examined by using first descriptive characteristics and afterwards statistical models (logistic regression) based on controlling (adjusting) for other confounding factors. The research covers the period from 1999 to 2008.

Analyzing perinatal deaths by various demographic and social factors during observation we will answer to the following questions:

1) Do the investigated factors affect pregnancy outcome?
2) Do significant differences exist in perinatal deaths by place of residence of mother?
3) Do parameters of marital status of mother affect at same level?
4) Are demographic factors more important than social factors?

1.3 Scientific relevance

Mortality varies widely, according to level of national economic, social, medical or cultural development. Patterns differ not just between countries, but also between national subpopulation – be they regional or local – as well as subgroups within a population defined by membership criteria like gender, social status, marital status, educational level, occupation, etc. In fact, any criteria of differentiation used, provided it has a social, economic, psychological, cultural, or other significance for health and mortality, is highly likely to reveal mortality differential.

The determinants of perinatal mortality, which are generally different from medical causes of death, can be analyzed, explained, or acted on at different levels. The coexistence of very different mortality systems is generally interpreted at the macro-societal level in terms of the level of economic and social development. The association between national and regional levels of perinatal mortality and level of development, measured according to various indicators, is so systematic that perinatal mortality is generally considered to be one of the most sensitive indicators of a country's level of development. At the individual level, the extent of social inequality in perinatal mortality could also serve as an indicator of equity in the distribution of resources within country.

The determinants of perinatal mortality have been traditionally identified by simple comparative analyses of available data. The term determinants were then attributed each time a variable shows a recurrent significant association with perinatal mortality in various situations.

At the national level, political choices made by governments are likely to improve female literacy and education of young girls, increase access (physical and financial) to health care, and improve living conditions (e.g., through reclamation of swampy land, installation of sewage systems, extension of drinkable water distribution, collection and treatment of waste). They may also promote access to employment with a view to ensuring better living standards for all (Masuy-Stroobant, 2001).

At the community level, the quality of water for domestic use or the availability of drinking water; access to electricity and to a sewage system; a healthy environment; adequate housing; and climatic conditions have been major determinants of the mortality decline in Europe until the early 20^{th} century and are still important factors in poor, high-mortality countries. Access to health services (preventive and curative) at the local level is also a part of this group of determinants. Generally, the urban or rural nature of the area determines access to such collective services (Masuy-Stroobant, 2001).

The household's composition where a child is born and the importance given to each member in the division of tasks or the distribution of available resources (e.g., food, health care, education) may be promising research themes, as well as the status of women and girls in particular and the relation of children to adults in general. Beyond the analysis of the bargaining power between generations or between spouses, an analyst has to consider the help and the affective or psychological support the household members, relatives, and friends can provide in sharing childcare.

At the individual level, the position of the infant's family in the social hierarchy affects in various ways access to resources needed to maintain good health and copying strategies for everyday life conditions. This position is often measured by the father's income and occupation or mother's level of education. The legal nature of the union, the nationality, and the ethnic group are other social status criteria.

The mother's biologic characteristics, such as her own weight at birth, her pregestation weight, and weight gain during pregnancy, are other nutritional indicators that enable us to predict a child's birth weight and, consequently, its frailty (Masuy-Stroobant, 2001).

Our results can contribute to the understanding of the problem of perinatal mortality in the Republic of Kazakhstan, bringing new insights into problem, explaining the process in the context of social and demographic factors.

This thesis helps to illuminate the recent trend in perinatal deaths and to find the role of different social and demographic factors in reducing them. Studies on perinatal deaths in Kazakhstan are scarce. An analysis related to perinatal deaths can be undertaken, thanks in part to infant and child mortality studies done in Kazakhstan by WHO and UNICEF. Moreover, perinatal death studies in Kazakhstan did not consider such factors as mother's age, marital status, place of residence, child's gender, and birth order. Advanced statistical analysis based on unpublished Kazakhstani statistical data, concerning perinatal deaths according to various characteristics of the childbearing population, allows the effects of factors to be disentangled in a more sophisticated way, yielding interesting conclusions and contributing to the understanding of the phenomena.

It is clear that for analyzing recent trends in perinatal mortality, event history theory and methods play an important role. There is no scientific literature from which we can paint the historical and methodological background of perinatal mortality in Kazakhstan, so theories and methods which were observed and analyzed in studies and research dealing with European countries have been used as a theoretical framework.

Logistic regression techniques were employed in order to determine the various effects of social and demographic factors on perinatal deaths. SAS software was used to this end. The introduction of SAS software packages in this thesis may be particularly helpful to the reader who is interested in data analysis. The analyzed data offers further opportunities for exploiting new knowledge about perinatal death in Kazakhstan.

1.4 Societal relevance

Studies on infant and perinatal death rates have a serious relevance to society. The decline in late fetal mortality has been uninterrupted in the industrialized world since the end of World War II. This has been the result of a combination of demographic factors (completed fertility, frequently limited to 1- 3 children, hence fewer high-parity births and the rarity of motherhood at older ages) and especially of major advances in the fields of prevention, fetal surveillance, and obstetric and neonatal techniques, which have led to an extreme medicalization of childbearing and to increasingly common intervention practices, not always taking into account the medium- and long-term consequences for parents and children (Gourbin, 2006).

The introduction of social protection systems and preventive health care policies has been responsible for an improvement in working conditions during pregnancy and for more effective prenatal monitoring. Working conditions of pregnant women are regulated in most industrialized countries.[1] The most common measures are exemption from night working, change of work place if it represents a physical (i.e., toxic or mechanical) hazard for the mother or unborn child, permission to make prenatal medical visits in work time. In the case of sickness (with a medical certificate), the women is put on sick leave and is entitled to receive all or part of her salary for however long its duration (WHO, 1988).[2]

Medical supervision of pregnancy can be compulsory or based on government recommendations (Denmark) or be the responsibility of occupational organizations (The Netherlands) (Demont et al., 1990). The minimum statutory number of compulsory prenatal visits is usually smaller than the recommended by the medical profession, three or four instead of nine, the latter figure being close to the average number of visits actually carried out (usually 12). It is generally recommended that the first visit take place in the first trimester of pregnancy, and some countries offer a financial incentive to this end. In France, where such a payment exists, a survey conducted in 1987 found that 4.3 of mothers in the most disadvantaged social strata nonetheless did not receive this allowance because they have failed to respect the conditions (Blondel and Sourel-Cubizolles, 1991). The proportion was 21% in the United States in 1993 (National Center for Health Statistics, 1995), reaching 34% in the black population. Medical check-ups can be carried out by midwives, general practitioners or specialists. The trend is to a greater role for doctors, in particular obstetricians. A system of home visits to pregnant women by midwives or specialist nurses is also operating in some countries. Prenatal visits are also an opportunity for women to be informed and educated about pregnancy and birth, and to receive advice about their personal life styles and preventive behaviors they should adopt.

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[1] It can be noted however that at the end of the 1980s Denmark, Sweden, and Norway, countries where levels of late mortality have been low for many years, had no mandatory protection of pregnant women at work. There were instead merely recommendations.

[2] These measures seldom extend to self-employed groups and female farm workers.

1.5 Overview of literature

Unfortunately, there is almost no serious demographic research dedicated to an in-depth analysis of the perinatal mortality in Kazakhstan (I am not concerned with medical themes here). This literature review therefore mainly relies on foreign sources.

Fetal, perinatal and neonatal mortality rates are widely used as indicators for cross country comparisons of health status and quality of obstetric and neonatal care. Differences in registration practices such as variable lower registration limits for gestational age and birth weight and in policies and practices of screening for congenital anomalies all have an impact on calculated perinatal mortality rates. Variations in perinatal mortality may also result from differences in the demographic characteristics of the childbearing population.

When investigating perinatal mortality trend in Kazakhstan it has been used some reports from WHO. One of them is “Neonatal and perinatal mortality: country, regional and global estimates” (Geneva, 2006). In the report definitions, methodology, methods of calculation for various perinatal and neonatal indicators are introduced.

In studying perinatal mortality in Kazakhstan and analyzing different social and demographic factors that affect perinatal death it has been considered infant and perinatal mortality studies. In this field it is essential to note following researches: Tromp M, Eskes M, Johannes B Reitsma… [et al.]: “Regional perinatal mortality differences in the Netherlands; care is the question”, 2008; Ling Huang, Reg Sauve, Nicholas Birket… [et al.]: “Maternal age risk of stillbirths: a systematic review”, 2006; Ravelli AC, Eskes M, Tromp M, H… [et al.]: “Perinatal mortality in the Netherlands 2000–2006; risk factors and risk selection”, 2008; J. Rychtarikova, “Do maternal and paternal characteristics perform similar roles in adverse pregnancy outcome and infant survival?”, 2001.

Tromp and Eskes (2008) analyzed regional variation in perinatal mortality within the Netherlands. Differences in perinatal mortality were calculated between 4 distinct geographical regions North-East-South-West. They tried to explain regional differences by adjustment for the demographic factors maternal age, parity and ethnicity and for socio-economic status and urbanization degree using logistic modelling. In addition, regional differences in mode of delivery and risk selection were analyzed as health care factors. Finally, perinatal mortality was analyzed among five distinct clinical risk groups based on the mediating risk factors gestational age and congenital anomalies. Differences in adverse outcomes by region and province were tested by Chi-Square test using all other regions/provinces as the reference category. Differences in population characteristics by region were tested by Chi-Square test. After describing crude mortality rates, logistic regression modelling was used to estimate differences in perinatal mortality between regions after adjustment for socio-demographic factors. All previously described factors were added to the model in two successive steps. First they adjusted only for demographic factors as parity, maternal age and ethnicity, parity and maternal age were included as categorical variables with the category with the lowest mortality risk as the category of reference. In the second model they additionally adjusted for the degree of urbanisation. In both models they included the year of registration to incorporate changes in perinatal mortality over time. The strength of the association between potential predictors and perinatal mortality were expressed as odds ratios (OR) with 95% confidence intervals (CI). All analyses were performed using SAS for Windows (version 9.1, SAS Institute Inc., Cary, NC, USA).

Huang and Birket (2006) explored whether older maternal age is associated with an increased risk of stillbirth. They recorded both the crude and (if available) adjusted risk ratio or odds ratio and 95% confidence interval (CI) for stillbirth risk by maternal age for each individual study. Risk ratios and odds ratios greater than 1.0 indicate an increased risk of stillbirth among older women. They assessed the heterogeneity of the results of the individual studies using the Cochran Q-test for all studies, for population-based cohort studies, for hospital-based cohort studies and for case–control studies.

1.6 The layout of the study

In Chapter II, we consider the theoretical framework related to perinatal mortality, introducing definitions, historical trends of infant and fetal mortality in European countries, the historical background of relevant theories and the basic facts of perinatal deaths. At the end of this chapter, risk factors and related hypotheses are introduced. In section 2.1, we describe definitions related to perinatal, neonatal and fetal deaths. Internationally recommended definitions and the individual cases of registration practices of the perinatal period in countries such as Canada, the USA, and England, are presented. In section 2.2, attention is paid to the historical trends of infant and fetal mortality in European countries, especially Norway and England (1800-2006). An analysis of the historical trends of infant and fetal mortality in Norway and England also includes methods related to reconstructing infant and fetal mortality rates when some data are missing. Section 2.3 describes relevant theories concerning perinatal death. If section 2.2 presents data, methods, and calculations with missing data, then section 2.3 tries to describe determinants which can affect perinatal mortality, and how various scientists have tried to interpret the outcome of pregnancy by analyzing different factors at different levels. There are many given factors which can influence the outcome of a pregnancy, beginning on the individual level and ending with community-level factors. The next sections (2.4 & 2.5) of this chapter form a logical continuation of the previous section, and give us information about social, demographic, and other individual factors. Place of residence and marital status of the mother were considered to be the social factors of perinatal death. Age of the mother, child's gender and birth order were taken as demographic factors. The reason these factors were selected is related to the availability of data on perinatal death. The Official National Statistics of Kazakhstan (the main data sources of the analysis) do not provide the opportunity to receive data according to the many various characteristics (demographic, socio-economic, medical, etc.) of the childbearing population. Section 2.6 contains questions and hypotheses which will be analyzed and verified.

The methods and data used in the thesis are described in Chapter III. The first section (3.1) of the chapter shows the availability and quality of the data. The data for analyzing perinatal mortality in Kazakhstan were taken from the Official National Statistics. For the purposes of the study, aggregated data were taken from unpublished data sources for the years 1999 through 2008. Unpublished data were used because neither the Demographic Yearbook nor official published data provides crosstabulations on stillbirths and early neonatal deaths, according to various demographic and social characteristics of the childbearing population. Section 3.1 also presents the reliability and quality of the data used. The quality and reliability of the data can seriously affect the results of the study. For example, it was found that the perinatal mortality rate increased, surprisingly, in the last estimated year (2008). The sharp rate increase was due to an increase in the number of live births, stillbirths and early neonatal deaths. The reason for the increase in the number of live births and stillbirths was the result of newly adopted definitions recommended by the World Health Organization. Before the adoption of new definitions of live birth and stillbirth, Kazakhstan used the old so-called "Soviet" definitions of live births and stillbirths. Therefore, section 3.1.2 of the third chapter will describe the registration practices of live birth, stillbirth and perinatal periods and how different definitions and registrations can affect the results of perinatal mortality analysis. The second section (3.2) of the chapter contains information about the methods used. First, a description and definitions of the crude perinatal mortality rate and related infant mortality rates were given. Second, a standardized perinatal death rate adjusted for population composition was estimated. Section 3.2 also presents adjusted odds ratios (OR), a 95% confidence interval (CI) and a maximum likelihood estimation, where the association between risk factors and perinatal deaths is expressed by using these methods.

The core of the thesis is presented with the analysis of Chapters IV and V. Section 4.1 shows the trends in infant and perinatal mortality during the period of 1999-2008, changes in live birth and stillbirth definitions in the last observed year (2008), and the effect of newly-adopted definitions. The next sections of the chapter present the situation of perinatal death using crude and standardized perinatal mortality rates, according to the demographic and social characteristics of the childbearing population. Factors such as the mother's place of residence, marital status and child's birth order are analyzed for different age groups of mothers. Section 4.2 presents differences and variations in perinatal mortality according to mothers' age groups, child's gender and child's birth order. As in the case of section 4.2, section 4.3 presents the differences and variations in perinatal mortality between urban/rural places of residence and married/unmarried marital status of the mother. In sections 4.2 & 4.3, the causes and explanations of the differences between each variable are given. For example, what can be the reason for the big differences in perinatal mortality rates in urban and rural areas? The association between risk factors (age of the mother, child birth order, place of residence and marital status of mother) and perinatal deaths expressed as adjusted odds ratios (OR), a 95% confidence interval (CI), and the level of significance are analyzed in section 4.4. For this purpose, six models have been constructed using a logistic regression model. All operations related to logistic regression techniques were carried out with SAS software. Logistic regression used binary dependent variables (perinatal death or survival of the 7^{th} day) and independent variables (mother’s age, mother’s place of residence, mother’s marital status, and birth order).

Chapter IV also presents answers to the questions and hypotheses. Chapter V outlines national policy related to reducing perinatal deaths in Kazakhstan.

Chapter VI draws a general conclusion, discusses the relevance of the results of the thesis and provides recommendations. The list of references and annexes are located at the back of the volume.

2. Theoretical framework related to perinatal mortality

2.1 Basic concepts specification: definitions

Both the precise calculation of perinatal mortality indicators (and to a much lesser extent infant mortality rates) and the construction of an international ranking are strongly determined by the definition of live births, stillbirths, and abortion and by differences in policy and practice in registration. The perinatal mortality rate can vary by as much as 50 percent, for example, depending on which definition is used, and under-registration of perinatal mortality may amount to as much as 20 percent (Garssen, 2004).

Historical trends in different practices of registration of live birth and stillbirth in European countries in the past had a serious impact in conceptualizing of international recognized definitions related to perinatal, neonatal and infant deaths (Gourbin and Masuy-Stroobant, 1995). WHO has long recognized the importance of international comparison of perinatal and neonatal mortality and its components. One of the many tasks of WHO is to coordinate the compilation of health statistics and to encourage member countries to rely on the same definitions in order to allow for the comparison of those statistics. Events related to birth, death and the perinatal period, as well as the reporting requirements for the data from which internationally comparable statistics are drawn, are defined in the International classification of diseases (ICD).

The detailed definitions and instructions are contained in the 10th edition (ICD-10) (WHO, 1993), Chapter 5 "Standards and reporting requirements related to fetal, perinatal, neonatal and infant mortality" (WHO, 2006, Annex 1, pp. 43-47). Some key issues of neonatal and perinatal mortality are mentioned below and also illustrated in Figure 1:

Live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live born.

Fetal death (dead born fetus) is the death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles.

The **perinatal period** commences at 22 completed weeks (154 days) of gestation and ends seven completed days after birth.

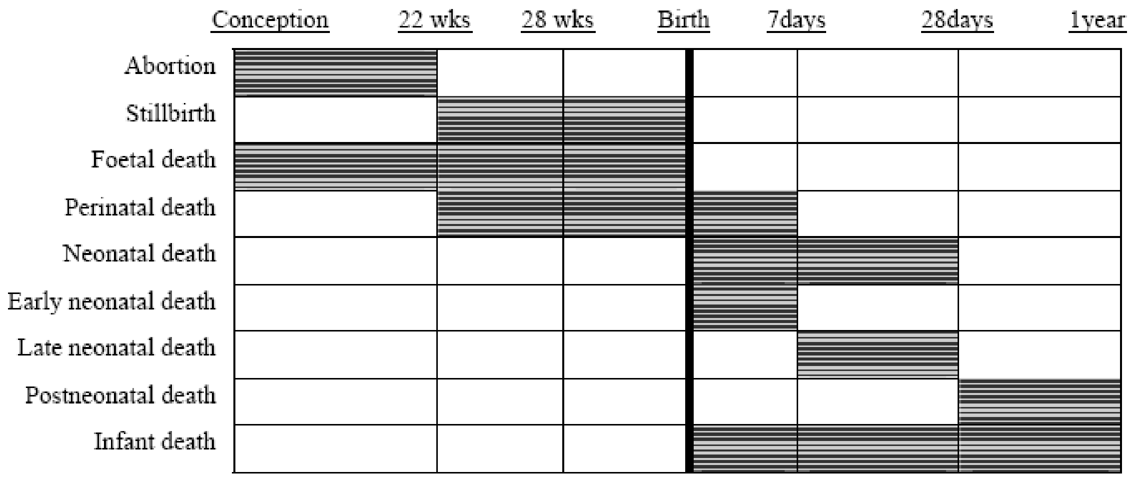
The **neonatal period** begins with birth and ends 27 complete days after birth. Neonatal deaths subdivided into **early neonatal deaths**, occurring during the first seven days of life (0-6 days), and **late neonatal deaths**, occurring after the seventh day of life but before the 28th day of life (7-27 completed days).

In some countries, however, the definition employed differs from the international recommendations: live born children dying early in life (e.g., before registration of birth or within 24 hours of birth) may be classed with fetal deaths. A more important problem is the incompleteness and irregularity of reporting of fetal deaths. This limitation applies to the data for most countries of the world. The duration of pregnancy required for registration varies widely. Reporting of early fetal deaths may be seriously incomplete even where required by law. When registration of all fetal deaths is not mandatory, countries differ as to what is to be registered as a late fetal death (stillbirth); 28 weeks is most frequently specified as the minimum period. As a result, international comparability is far greater for the late fetal deaths than for all fetal deaths taken together.

In view of this situation, the United Nations has recommended that fetal deaths be tabulated by period of gestation into four classes: under 20 completed weeks, 20 to 27 completed weeks, 28 to 36 completed weeks, and 37 completed weeks and over (and not stated). It has designated fetal deaths of at least 28 weeks of gestation, combined with fetal deaths of unknown gestational age, as “late” fetal deaths; fetal deaths under 20 weeks’ gestation as “early” fetal deaths; and fetal deaths of 20 to 27 weeks’ gestation as “intermediate” fetal deaths (UN, 2005).

Based on the period of the data collection this study includes two different practices of registration of live births and stillbirths. First (I) so-called “Soviet” and second (II) “WHO” registration practices of live births and stillbirths. The “Soviet” definitions of live birth and stillbirth differ from WHO definitions.

Figure 1 - Illustration of terminology applied to fatal events in the first year of life.



The Soviet definition only counts breathing as a sign of life, and presumes infants who are born before the end of 28 weeks of gestation, or who weigh less than 1,000 grams at birth (there is considerable overlap between these two groups) to be non-viable – they are not counted as live births until they have survived a full seven days (or 168 hours). If they survive for less than this time, they are considered as miscarriages, and not counted at all. Table 1 presents detailed differences in Soviet and WHO definitions of live births and stillbirths.

***Table 1 - Soviet and WHO definitions of live birth and stillbirth (1937-2008)*[3]**

	Infant born after the end of the 28th week of pregnancy			
	No signs of life	No breath but other signs of life	Died during the First 7 days	Survived the First 7 days
USSR	**Stillbirth**		**Live birth**	
WHO	**Stillbirth**	**Live birth**		
	Infant born before the end of the 28th week of pregnancy, or with weight under 1,000 gr. Or length under 35 cm			
	No signs of life	No breath but other signs of life	Died during the First 7 days	Survived the First 7 days
USSR	**Miscarriage**			**Live birth**
WHO	**Stillbirth**	**Live birth**		

Source: Anderson and Silver (1986)

It should be noted that Kazakhstan used the live birth definition till 2008 established by the former Soviet Union (see table 1). Nationwide registration of newborns according to the new criteria started in January 2008 where all newborns weighing 500 grams and more and with 22

[3] In Kazakhstan the definition of live births and stillbirths established by USSR have been used during the period 1937-2008, http://www.nczd.ru/upot.htm

weeks of gestation (instead of the 1000 grams and 28 weeks that was required under the former system) were registered as live births when any sign of life was present.

Nevertheless, the legal requirements for registration of fetal deaths and live births vary between and even within countries. WHO recommends that, if possible, all fetuses and infants weighing at least 500 g at birth, whether alive or dead, should be included in the statistics. The registration in national statistics of fetuses and infants weighing between 500 g and 1000 g is recommended both because of its inherent value and because it improves the coverage of reporting at 1000 g and over.

In Australia any stillborn baby weighing more than 400 grams, or more than 20 weeks in gestation, must have its birth registered (Australian Institute of Health and Welfare, 2009).

Throughout the United Kingdom, stillbirths must be registered by law. The Stillbirth Definition Act (1992) states: *"any 'child' expelled or issued forth from its mother after the 24th week of pregnancy that did not breathe or show any other signs of life should be registered as a stillbirth*" (Royal College of Midwives, 2009). In England and Wales, this must be done within 42 days and a Stillbirth Certificate is issued to the parent(s) (Directgov, 2009). In Scotland, this must be done within 21 days (General Register Office for Scotland, 2009).

In the United States, there is no standard definition of the term stillbirth (National Center for Health Statistics of USA, 1997). The Centers for Disease Control and Prevention collects statistical information on "live births, fetal deaths, and induced termination of pregnancy" from 57 reporting areas in the United States. Each reporting area has different guidelines and definitions for what is being reported; many do not use the term "stillbirth" at all. The federal guidelines recommend reporting those fetal deaths whose birth weight is over 350g, or those more than 20 weeks gestation. Forty-one US states use a definition very similar to the federal definition, thirteen areas use a shortened definition of fetal death, and three areas have no formal definition of fetal death. Only 11 areas specifically use the term stillbirth, often synonymously with late fetal death, however they are split between whether stillbirths are "irrespective of the duration of pregnancy", or whether some age or weight constraint is applied.

The National Health Data Dictionary of Australia (Australian Institute of Health and Welfare, 2009) defines the perinatal period as commencing at 20 completed weeks (140 days) of gestation and ending 28 completed days after birth.

At the time the WHO recommended this definition, Australia uses legal and statistical definitions for the perinatal period of birth weight (400grams) and gestational age (20 weeks) limits that were lower than in the WHO definition. In addition, the upper age limit for the perinatal period in Australia was set at 28 days (Australian Department of Health and Ageing, 2009). This broader definition of the perinatal period in Australia was considered to comply with and extend the WHO definition.

This study includes two different definitions of perinatal mortality according to data collection. Perinatal definition first (I) includes infant deaths of less than 7 days of age and fetal deaths of 28 weeks of gestation or more. Perinatal definition second (II) is the most inclusive definition, and includes infant deaths of less than 7 days of age and fetal deaths of 22 weeks or more.

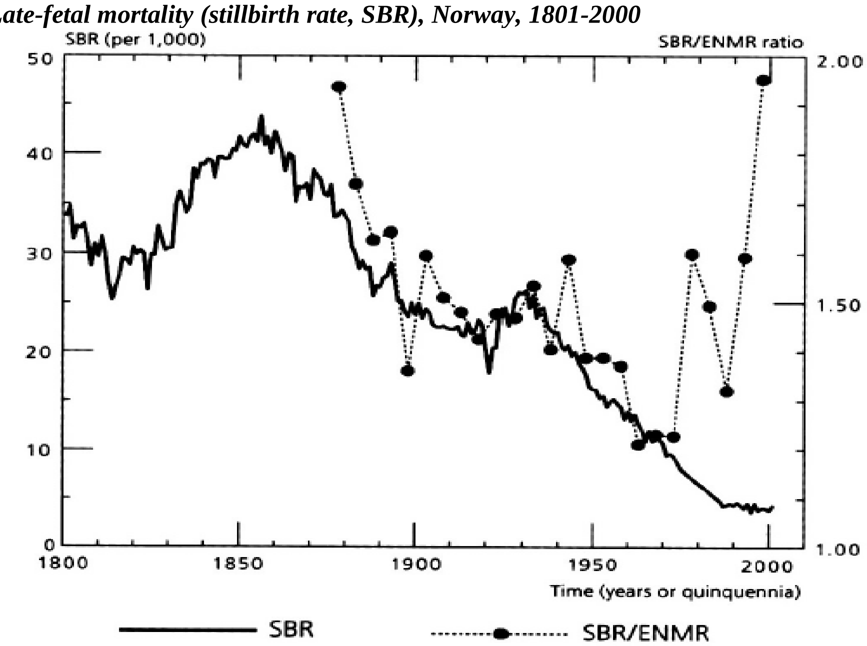
2.2 Historical trend: infant and fetal mortality

This section of the chapter describe historical trend on infant and fetal mortality in European countries. Although historical demographers appreciate the importance of fetal mortality, the subject has received relatively little attention compared with infant mortality (Bideau et al., 1997; Garrett et al., 2006). This is partly due to the lack of registration data for all but a handful of countries in the nineteenth century, but also to the suspicion that the definition of stillbirths is likely to have been both clinically and culturally variable (Gourbin and Masuy-Stroobant, 1995). Drawing the distinction between miscarriages (non-induced abortions) and stillbirths required the ability to assess gestational age, while recognizing key vital signs also demanded experience and consistency. It is, therefore, quite likely that even where stillbirths were registered, the quality of that registration will have varied over time (Woods et al., 2006). The case of Norway is often used as an example (including WHO, 2006, p. 54) because stillbirths were registered from 1801, and by the 1870s new regulations led to extremely refined reporting of age at death among infants. This helped to sharpen the definition of live births used by midwives and medical practitioners, making it possible to register deaths during the first 24 hours after a delivery of a live birth as well as fetal deaths before and during delivery. There is every indication that the Norwegian statistics on early-age death are as reliable as any could be prior to 1900, although Sweden did begin the registration of stillbirths in the 1750s and has a longer series (Woods et al., 2006).

Figure 2 illustrates the annual stillbirth rates for Norway 1801-2000 and the ratio of the stillbirth rate to the early-neonatal mortality rate (SBR/ENMR ratio) by quinquennia from 1876-80 to 1996-2000. It shows that in Norway, as in many other developed countries, the stillbirth rate went into a secular decline during the late 1930s (see the method page). But it also reveals a wave-like rise and fall during the nineteenth century when SBR peaked at about 43 per 1,000 in 1850. The SBR/ENMR ratio followed a U-shaped pattern with decline followed by increase in very recent years as the stillbirth rate reached 4 per 1,000, but the early neonatal mortality rate declined to 2 per 1,000 (WHO, 2006, Table ALl, p. 32). It can be shown that Sweden, Denmark and the Netherlands behaved in broad agreement with the Norwegian pattern (Woods et al., 2006; Woods, 2008). Late-fetal mortality declined from the 1850s to the 1930s. Outside this area of northwest Europe it is extremely difficult to gain a clear picture since stillbirths were not routinely registered in the civil systems (e.g. Great Britain) or a significant minority of registered stillbirths were "false stillbirths" (perhaps 25-30%) i.e. infants who were born alive but died before registration (e.g. France). However, family reconstitution studies using ecclesiastical parish registers often provide estimates of neonatal, early-neonatal, endogenous (from biometric analysis) and maternal mortality for periods before 1800. The availability of these rates encourages the further estimation of late-fetal mortality.

England is an almost ideal case for such an estimation exercise. Stillbirths were not registered in England and Wales until 1927, and not until 1939 in Scotland. The civil registration of vital events began in 1837 (1855 in Scotland) and had a strong bias towards medical statistics, especially age at death and cause of death, although there was no particular focus on early-age mortality until the 1900s. The rich supply of Anglican parish registers, some dating from the mid-sixteenth century, has inspired demographic research, much of which has been technically ingenious (Wrigley and Schofield, 1981; Wrigley et al., 1997). The particular form of nominal record linkage developed for use on parish registers works most effectively where the registers are well kept, where the population is immobile, or where there is a short time interval between the vital events under consideration. In consequence, much effort has gone into the linkage of entries in baptism and burial registers, and the derivation of infant mortality rates. While these rates cannot be treated uncritically, they do provide a basis for estimating fetal mortality.

Figure 2 - Late-fetal mortality (stillbirth rate, SBR), Norway, 1801-2000



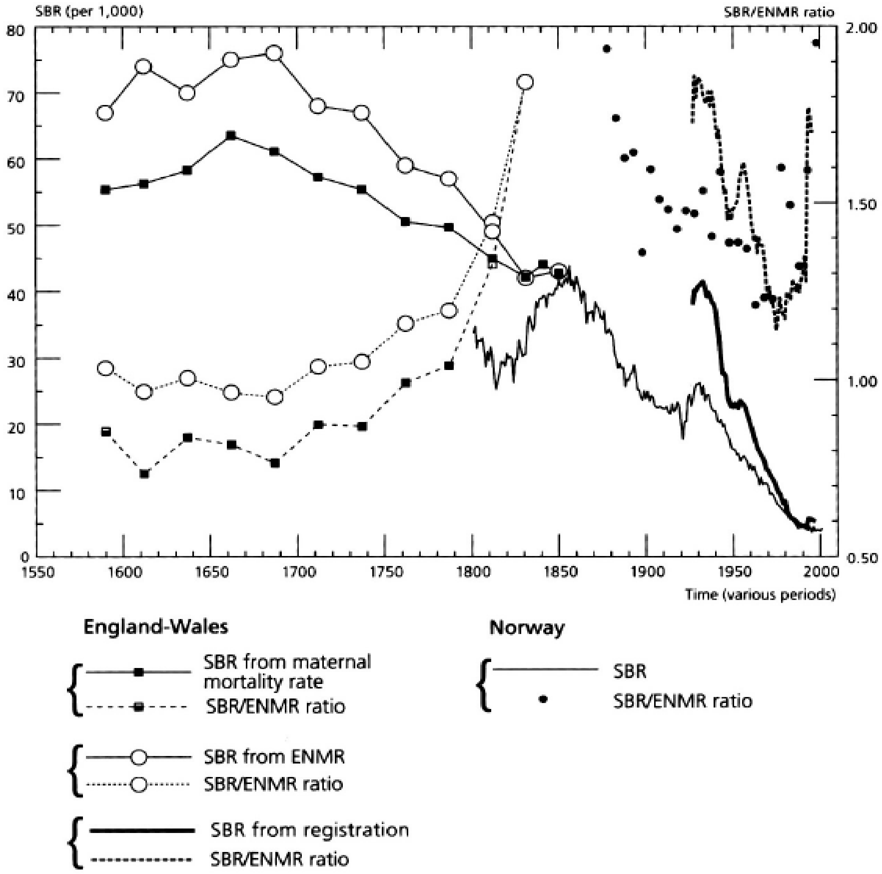
Source: Robert Woods, 2008[4]

[4] Cut from "Late-Fetal Mortality: Historical Perspective on Continuing Problems of Estimation and Interpretation" by Robert Woods, Figure 4, p. 599. Population; 2008; 63, 4: ProQuest Social Science Journals

What is lacking is a full understanding of the ways in which late-fetal and neonatal mortality may vary together in low life expectancy historical societies or, failing this, some empirical rule by which early-neonatal mortality rates might be converted into stillbirth rates. In the WHO report this rule was supplied by the SBR/ENMR ratios for separate mortality strata. Several scholars have already considered this matter. Hart (1998) used early-neonatal mortality as base rate, which she multiplied by a single inflation factor (1.8) derived from the SBR/ENMR ratio for England and Wales in 1931. Wrigley (1998) favoured the use of endogenous mortality as base, to which he applied an inflation factor of approximately 1.5. More recently, Woods (2005) has argued that both Hart and Wrigley have over-estimated the stillbirth rate by selecting inflation factors that were both high and constant. Norway in Figure 2 and the WHO report (2006) demonstrate that whichever inflation factor is chosen, its value must be allowed to vary over time, through the mortality transition and between levels of socioeconomic development. For England, Woods (2005) used the variation among administrative districts in England and Wales to establish the association between the stillbirth rate and the early-neonatal mortality rate in 1931, in combination with the association between the stillbirth rate and the maternal mortality rate (MMR, deaths associated with childbirth per 10000 deliveries or births), as ways of deriving inflation factors. Although far from ideal, this method was at least empirically grounded and it did generate SBR estimates reasonably consistent with expectations, as we shall see (Galley, 2008).

Figure 3 places the English experience alongside the Norwegian. It shows time-series for the stillbirth rate and the SBR/ENMR ratio for England and Wales derived from registration data from 1927 onwards and the Norwegian series from Figure 2. Both SBR/ENMR ratios follow similar U-shaped patterns from stillbirth rates of about 40 per 1,000 to less than 5 per 1,000, but in England and Wales this change took place over 60 years and not 150 years as in Norway. Late-fetal mortality remained stubbornly high in Britain before 1940, while in those northwest European countries for which we have long historical time-series (e.g. Norway, Sweden, Denmark), it began a period of steep decline in the late nineteenth century followed by stagnation during the early decades of the twentieth century. From the historical estimation perspective, the most interesting part of Figure 3 is on the left. It shows Woods' (2005) estimates of the stillbirth rate from the early-neonatal mortality and maternal mortality rate series derived by Wrigley et al. (1997), and the associated SBR/ENMR ratios. Given the close association between late-fetal and early-neonatal deaths and the link between stillbirths and maternal mortality, it is difficult to see why, with reasonably reliable estimates of early-neonatal mortality and maternal mortality; it should not be possible to derive meaningful stillbirth rates.

Figure 3 - Estimated late-fetal mortality (stillbirth rate, SBR) and ratios of stillbirths to early neonatal mortality (ENMR), England-Wales and Norway, selected periods



Source: Robert Woods, 2008[5]

Figure 3 suggests that in England the stillbirth rate was around 60 to 70 per 1,000 total births during the late seventeenth and early eighteenth centuries, and that it declined to around 40 per 1,000 by the mid-nineteenth century. However, the SBR/ENMR ratio was at or below 1 before 1800. The WHO study (2006, pp. 53-54) is skeptical about ratios below 1 occurring in their high mortality strata. A ratio of 1.2 is preferred. The use of such a ratio in the case of seventeenth- and eighteenth-century England would push the stillbirth rate to a position well beyond the worst conditions believed likely to apply in parts of west and central Africa in 2000. According to Woods estimates, the worst years illustrated in Figure 3 equal the highest national levels of fetal mortality reported by the WHO. There is, of course, the possibility that historical demographers have over-estimated the levels of early-neonatal and maternal mortality in earlier centuries. It seems more

[5] Cut from "Late-Fetal Mortality: Historical Perspective on Continuing Problems of Estimation and Interpretation" by Robert Woods, Figure 5, p. 601. Population; 2008; 63, 4: ProQuest Social Science Journals

likely that family reconstitution techniques applied to English parish registers would miss some live births and early-age deaths because neither vital event was marked by an ecclesiastical ceremony and their consequent register entries. If Anglican registration fell out of fashion, as it did in some places during the eighteenth century, then one would expect early-neonatal mortality to be under- rather than over-represented. It is also possible that the method of deriving historical stillbirth rate series from early neonatal or maternal mortality rates is flawed. The stillbirth rate would need to be unreasonably high for the SBR/ENMR ratio to fall in the range regarded as acceptable by the WHO or consistent with twentieth-century experience. Hart (1998) and Wrigley (1998) would need to be correct in their belief that the stillbirth rate in early eighteenth-century England was well in excess of 100 per 1,000, 120-140 per 1,000 even, twice the rate estimated for Mauritania in 2000.

2.3 Relevant theories and basic facts

2.3.1 Substantive concerns

In an overview of research conducted by demographers in the area of mortality, Eileen Crimmins (1993, p.589) wrote the following:

"Mortality research remains largely descriptive, as was the fertility research of 30 years ago. Because no "theory" of mortality currently exist, this area is likely to undergo considerable theoretical development in the coming decade. Currently, the emphasis is placed on describing differences according to race, ethnicity, and social class. New independent variables, such as social support, are suggested regularly as possible explanatory variables for mortality differences, but the mechanisms through which these variables might work often remain unspecified."

This comment adequately summarizes the situation of field research in this area, even if some recent attempts to test the effect of maternal education (Sandiford et al., 1995) or the evaluation of the respective effects of contextual determinants (collective services such as water or electricity supply) and individual determinants (socioeconomic and behavioral characteristics) are interesting in explaining, for example, rural-urban differential in child mortality in Brazil (Sastry, 1997).

Nevertheless, in conceptualization of theoretical issue on perinatal mortality it is essential to note infant and fetal mortality studies of different authors, W. Parker Frisbie, J. Rychtarikova, G. Masuy-Stroobant, John C. Caldwell and others.

To explore perinatal mortality trend and to determine factors affected to perinatal deaths it have been studied some theoretical issues on infant mortality, how demographers have tried to theorize infant mortality as a social phenomenon and the way these theoretical assays are actually translated into statistical models for explaining the widely acknowledged effect of different social, demographic, and medical factors on infant or child survival during the study.

The infant mortality rate (IMR) defined as the risk for a live born child to die before its first birthday is known to be one of the most sensitive and commonly used indicators of the social and economic development of a population (Masuy-Stroobant, 2001). The association between deprivation and poor survival in infancy was already documented with survey data as early as 1824 (Masuy-Stroobant, 2001, quoted by Lesaëge-Dugied, 1972). The association between socio-economic factors and infant mortality was further reinforced when improvements in overall infant mortality levels over time ran parallel with general social and economic development in most industrialized countries during the twentieth century. Furthermore, since the Second World War, corroboration of the strong inverse relationship between socio-economic development and mortality rates has been found repeatedly among countries and areas within countries. At the individual level, significant social inequalities are repeatedly recorded, even when the overall IMR reaches very low levels (Masuy-Stroobant, 2001, quoted by Haglund et al., 1993). Links between individual- level social inequalities and regional (aggregate-level) differences are partly explained by relatively high spatial concentration of the deprived and of populations of lower social class (Masuy-Stroobant, 2001). Many studies have also pointed out inequality in infant survival within a population according to biological, social and behavioral factors (Cramer 1987; Carlson et al 1999).

The general substantive issues motivating the study of infant mortality are the same as those in other areas of research—the documentation and explanation of variation in the outcome of interest. Demographers have documented variation in infant mortality along many dimensions—temporal, spatial (neighborhoods, communities, nations, etc.), and between groups within societies. There is also a growing interest in the development of conceptual frameworks that can adequately inform studies based on multilevel models (those which include both individual and contextual variables).

2.3.2 From the identification of determinants to the design of conceptual frameworks

The high infant mortality levels experienced by European populations in the past (IMRs ranging from 80‰ to 250‰ by 1900) and the less developed countries today (with populations still experiencing IMRs above 140‰, like Guinea-Bissau, Sierra Leone or Afghanistan as estimated by the US Population Reference Bureau for 1997: Boucher, 1997 show some similarities: their causes of death were and are mainly of infectious origin, and the high mortality levels experienced during the first year tend to continue, although at lower levels, during childhood (i.e. until age five).

Historical studies on infant mortality brought about the quite general observation that a good deal of its decline could be achieved before efficient preventive and curative medication (vaccination against measles, whooping cough, tetanus... and antibiotics) was made available: “the historical evidence is consistent with the view that medical interventions could only have affected mortality in general and infant mortality in particular after 1930” (Masuy-Stroobant, 2001).

Even though death is a biological event, mainly caused by a specific disease, the demographic study of the determinants of infant and child mortality will concentrate on the (cultural, environmental, social and behavioral) factors, which may influence the likelihood of ill health, disease and death in early infancy. Research on the historical decline of infant and child mortality in Europe has thus identified retrospectively a wide series of determinants which are also known to explain the present-day situation in high mortality populations. Climatic and seasonal variations in mortality by diarrhea have shown the importance of ecological conditions; significant spatial correlations between regional IMRs and infant feeding practices (whether the infants were breast-fed, bottle fed, currently receiving foster care….) were also abundantly documented; *social factors* as indicated by the excess mortality of illegitimate infants, or the striking rural-urban differences observed during the industrialization process (Naomi Williams and Chris Galley, 1995, p.405 explain the nineteenth century urban disadvantage by the "urban-sanitary-diarrheal effect" due to poor sanitation, overcrowded housing, poverty …) (Masuy-Stroobant, 2001) played also an important role in European history; finally, the *high fertility patterns* we have known, did also exert an effect on infant and child survival, through shortened birth intervals, family size, etc. Infant mortality started its decline in Europe and the USA by 1900, several decades after a decline in early childhood and general mortality had begun. Nutritional improvements (Masuy-Stroobant, 2001), sanitary reforms (i.e. the provision of sewage disposal and clean water supply systems in towns) and improved personal hygiene (Ewbank and Preston, 1990) were put forward to explain the decrease in general and in childhood mortality. Infant mortality appears to resist to these improvements until quite similar « Child Welfare Movements » were organized in most European countries and the USA (Masuy-Stroobant, 2001) by the very end of the nineteenth-beginning of the twentieth century. Their health education activities were built on an increasing awareness of the germ theory of disease (Masuy-Stroobant, 2001) and the growing agreement "*that the mother needed education in proper infant care practice"* especially regarding feeding practices. Major emphasis was thus placed on breast-feeding, on providing clean and adequate food to the non breast-fed infant – heating of milk and sterilization of bottles were important innovations in this regard – and on keeping the baby and its direct environment clean. At first based on private initiatives, various educational activities aimed at mothers were progressively implemented through the organization of Milk Depots (in French, "Gouttes de Lait" ensuring the distribution of ready-to-use clean and bottled milk to the poorer mothers who could not breast-feed their infant), infant consultations, where the babies were weighted and examined by a medical doctor, networks of Home Visiting Nurses and Midwives. Educational efforts were also aimed at schoolgirls: they were taught « … the value of domestic hygiene, the dangers of filth, and what to do about infectious diseases » (Ewbank & Preston 1990). Mass education campaigns were also organized by the Red Cross during the First World War to teach mothers the basic principles of the 'new' child care practices by means of public demonstrations. The content of the information / education provided did not vary much from one country to another since International Congresses were held to exchange information and experiences gained in the different countries (Masuy-Stroobant, 2001, quoted by Congrès Internationaux des Gouttes de Lait, Paris 1903; Bruxelles 1906; Berlin 1912) in order to improve the action. These often local initiatives were later on (around the First World War) institutionalized and generalized in Europe through the Maternal and Child Health Systems, whose main objectives were and are still the development of preventive care through information, education and early detection of health problems.

Training in the 'new' infant care practices seemed thus to be the key to reduce infant mortality. Later evidence however worked out in the context of inter-war France has shown that *the general education level of the mother* was more efficient towards adoption of the new infant care practices (and of a more general preventive attitude) than any specific training course in those matters.

Moving towards less developed countries, John C. Caldwell (Masuy-Stroobant, 2001) with reference to Nigeria argues that "maternal education cannot be employed as a proxy for general social and economic change but must be examined as an important force in its own right. Furthermore, in Nigeria, as doubtless in much of the Third World, education serves two roles: it increases skills and knowledge as well as the ability to deal with new ideas, and provides a vehicle for the import of a new culture". He then further develops three main hypotheses on the mechanisms through which maternal education is supposed to exert its effects on the health of children:

"The first explanation is usually given as the only reason. That is that mothers and other persons involved break with tradition or become less 'fatalistic' about illness, and adopt many of the alternatives in child care and therapeutics that become available in the rapidly changing society.

The second explanation is that an educated mother is more capable of manipulating the modern world. She is more likely to be listened to by doctors and nurses. She is more likely to know where the right facilities are and to regard them as part of her world and to regard their use as a right and not as a boon.

There is a third explanation, which may be more important than the other two combined. That is, that the education of women greatly changes the traditional balance of familial relationships with profound effects on child care."

2.3.3 General Conceptual Approaches

In general, two theoretical frameworks have been used by demographers to provide guidance and structure in research on pregnancy outcomes. The first has been termed the social model, and the second is often referred to as the medical model (Parker, 2005). ''Social models stress the power of social variables to determine infant survival and the importance of structural change in overcoming disparate outcomes. Medical models stress pathways of frank pathophysiology and their potential interruption through clinical interventions’’ (Parker, 2005). Not surprisingly, most demographers and other social scientists have relied on the social model, while public health and medical researchers have primarily used the medical model. Until fairly recently, many researchers have proceeded as if the two approaches were competing.

Today, the situation is changing. The involvement of demographers in multidisciplinary research is facilitated by the fact that the social demography of infant mortality has drawn heavily on the proximate determinants approach advanced by Mosley and Chen (Parker, 2005). Despite a keen interest in those factors, especially socioeconomic variables that are more causally distant from the outcomes of interest, the heart of the approach ‘‘is the identification of proximate determinants that directly influence the risk of child mortality’’. Although the Mosley-Chen typology includes maternal characteristics, it is heavily weighted in the direction of biomedical factors, including environmental influences, nutrition, injury, and personal illness control (preventive and remedial) as intervening factors, thereby helping to set the stage for integrating the social and medical approaches.

This conceptual scheme is most applicable in studies of child mortality and morbidity. However, in infant mortality research, this framework has been adapted and expanded so that race/ethnicity, nativity, and other factors have joined SES as the most distal variables. Birth weight, gestational age, and maturity of infant are viewed as the most vital proximate determinants.

Basically, Mosley and Chen’s framework provides a clear distinction between socio-economic determinants (on which social science research has devoted most of its work and which were largely ignored by medical research) and proximate determinants (encompassing indicators of the various mechanisms producing growth faltering, disease and death, most commonly analyzed in medical research) of child survival in developing countries:

1. The proximate determinants: should be measurable in population based research. They comprise *maternal factors* (age at birth, parity and birth intervals); *environmental contamination* (intensity of household crowding, water contamination, household food contamination or potential faecal contamination); *nutrient deficiency* (nutrient availability to the infant or to the mother during pregnancy and lactation); *injury* (recent injuries or injury-related disabilities); *personal illness control* (use of preventive services as immunizations, malaria prophylactics or antenatal care, and use of curative measures for specific conditions).

2. The socio-economic determinants, which are operating through these proximate determinants, are grouped into three broad categories of factors

- *Individual-level factors*: individual productivity (skills, health and time, usually measured by mother’s educational level, whilst father’s educational level correlates strongly with occupation and household income); tradition/norms/attitudes (power relationships within the household, value of children, beliefs about disease causation, food preferences).

- *Household-level factors*: income/wealth effects (food availability, quality of water supply, clothing/bedding, housing conditions, fuel/energy availability, transportation, means to purchase what is necessary for the daily practice of hygienic/preventive care, access to information).
- *Community-level factors*: ecological setting (climate, temperature, altitude, season, rainfall), political economy (organization of food production, physical infrastructure like railroad, roads, electricity, water, sewage… political institutions), health system variables.

2.3.4 From the analytical framework to statistical modeling

Considering different determinants of infant and perinatal mortality it has been found huge number of factors which affect on infant deaths at different levels. Some of these risk factors are related to the mother, others to the child. Well-known risk factors for the mother are age, marital status (especially single motherhood), pregnancy history, socioeconomic status, height, ethnic origin, smoking and drinking, fertility treatment, chronic disease and complications during pregnancy and childbirth. For the baby risk factors include pregnancy duration and weight at birth, multiple births, sex, position at birth and congenital abnormalities (Richardus et al., 1998). This study will look mainly at the risk factors which is available from the national statistics.

At that time, especially in light of the massive number of the individual level studies of infant deaths, it is useful to organize the discussion of this literature according to the hypothesized ordering of effects, beginning with demographic factors and proceeding through social variables. Based on a review of the literature, Table 2 presents a reasonable partial ordering and one which, at least in a general way, reflects demographic consensus regarding the nature of individual risk factor effects.

Among those effects social, demographic factors include variables: mother's age, place of residence and marital status, child sex and birth order.

Table 2 - Selected Social and Demographic Factors Affecting the Risk of Perinatal mortality

Demographic Factors	Social Factors
Sex of child Mother's age Child birth order	Mother's place of residence Marital status

2.4 Demographic factors

Perinatal mortality varies considerably over the mother's reproductive career and this variation in risk can be examined using the conventional characteristics of age and parity. Their influence on late fetal mortality was evaluated in 1938 by Yerushalmy (quoted by Morris and Heady, 1955);

Shapiro et al. (1962) emphasized their importance throughout fetal life by describing the increasing risk of death with age and parity. Other aspects of women's reproductive life are also implicated.

2.4.1 Sex of child

According to the survey conducted by the WHO in several countries on the determinants of perinatal mortality (WHO, 1978), the child's sex has an uncertain role in late fetal mortality, because the results vary from country to country. However, an analysis of the data for England and Wales by Waldron (1983) shows that the excess male mortality existing before 1960 subsequently declined and the differential is now almost nonexistent. The hypothesis put forward to explain this decline is of a change in the causes of excess male mortality. Because boys usually have a higher birth weight than girls (for the same gestational age), their delivery can take longer, thus increasing the risks of fetal distress and death during birth. This would imply that boys have gained most from the improved obstetric techniques that are responsible for a reduction in mortality from hypoxia and trauma.

2.4.2 Maternal age

Numerous analyses have found an association between *maternal age* and pregnancy outcomes that shows the risk of infant mortality to be higher for both teenage and older mothers (Singh and Yu 1996). Research into the link between infant mortality and mother's age shows a U-shaped relation, with the highest risks for babies of very young and relatively old mothers (Geronimus, 1992). On the basis of Dutch data (from the national obstetrics register), Van Enk et al. (2000) showed that teenage pregnancies are unfavorable from a medical point of view, with an increased risk of premature birth and perinatal death. According to this study children of very young mothers have a higher risk of perinatal mortality, even after correction for premature birth.

Unlike older mothers, for younger mothers physiological reasons probably play only a small role in perinatal mortality (Van Enk et al., 2000) and infant mortality. Other factors, such as an unfavourable socio-economic position, the absence of a partner, a (related) lack of social support and a relatively high prevalence of sexually transmitted diseases play a greater role in this age group. In turn, these factors are strongly correlated to ethnicity. Infants of non-western foreign mothers turn out to have a risk of mortality that is around one third higher than average (Van Duin, 2002; Garssen et al., 2003). Very young maternal age may be acting as a proxy for social disadvantage, and teenage childbearing has been associated with a life-long history of exposure to unhealthy conditions which may lead to ‘‘weathering,’’ i.e., a diminution of a woman's health endowments (Geronimus 1987; Geronimus and Korenman 1993).

2.4.3 Child birth order

Maternal age needs to analyzed jointly with *parity* (or birth order) because the chances of adverse pregnancy outcomes are greater for ‘‘primiparas 30 years of age and over and multiparas under 18 years of age’’ (Kleinman and Kessel 1987: 751). Others report that first births are more at risk of low birth weight, perhaps as a result of pregnancy complications (Kallan 1993). The risk of late fetal mortality is slightly higher in primiparous women, falls back at birth orders two and three, and then rises steadily in the higher parities (Pinelli, 1984). Some studies claimed a doubling of risk from the sixth birth (Heady et. al., 1955; United Nations,1954). The differences in risk between first births and second and third births are not always obvious (Leridon, 1976; Bross and Shapiro, 1982), and regardless of the birth order considered, the results have to be qualified to allow for the difficulty of distinguishing the effects of age from those of parity (Wilcox and Gladen, 1982; Risch et al., 1988).

2.5 Social factors

2.5.1 Place of residence

It is well-documented that social stratification measured either by socioeconomic status of individual families or by residence in a population center of a particular size, is reflected in the physical growth and development of people, their health status, and some demographic variables. In particular, in many countries at present, slower rates of growth and maturation, and shorter stature, are observed among people living in rural villages rather than in urban centers (Bielicki et al., 1981, 1988; Bogin, 1988; Cameron et al., 1992, 1993; Henneberg and La Velle, 1999; Hulanicka et al., 1990; Jedlin´ska, 1985; Komlos and Kriwy, 2002; Pasquet et al., 1999; Pena et al., 2003; Spurgeon et al., 1994; Susanne, 1984; Tanner and Eveleth, 1976; Weber et al., 1995).

The use of perinatal and neonatal mortality rates as indicators of general standards of health and well-being in a community is now widely accepted. It is generally recognized that perinatal and neonatal mortality may result from a wide variety of influences, many of which are inter-related. These vary from genetic and physiological factors on the one hand to the social and economic environment of the mother, not only during the current or previous pregnancies but also throughout the whole of her life, on the other. The availability and quality of medical care is also important, although it is not clear precisely to what extent deficiencies in environmental and biological circumstances may be overcome by purely medical measures.

Factors related to regional differences in perinatal outcome reported in European countries after adjustment for demographic factors, include population density (Dalveit et al., 1999), access and use of health services (Gissler et al., 1987), income level and social inequality (Lauria et al., 2003) and excess risk for certain conditions (Serenius et al., 2001).

In order to capture a most exact situation of life quality, i.e. of life conditions in urban and rural area, we have structured the main aspects of the differences in both areas, in three important parts:

- infrastructure and services in the rural area;
- economic growth and income as factors of development;
- access to education.

Undoubtedly, all mentioned aspects population development indicators are played an important role in analyzing urban and rural differences. Nevertheless, reviewing literature on different infant and mortality studies related to urban/rural residence of mother we have found that fetal and infant health outcomes are important measures of the overall health of a population and of the quality of health care services for mothers and their babies. Further, they are key to monitoring and understanding the impact of changing health care practices. They are necessary, for example, for measuring the extent and impact of antenatal screening and for monitoring the effect of changing practices in the care of extremely preterm babies. Thus, an importance of accessibility and quality of medical services play an important role in analyzing differences in perinatal mortality between urban and rural area.

When comparing highway safety information between rural and urban areas, it becomes evident that a disproportionate number of severe crashes occur in rural areas. Population's access to medical services is hindered by the deficit transport services, and the quality of medical services is hindered by the very old or even absent medical equipment, by the low number of doctors, and by the professional skill level of the medical staff. In most communes, there are only basic medical services. In order to benefit from specialized services, inhabitants of rural areas have to go to town.

In many European countries mostly in urban area, perinatal and infant mortality in the second half of the 20th century have declined due to increasing of quality and availability of medical services. Analyses of time trends on aggregated preventable mortality data have suggested that at least part of the mortality decline for avoidable conditions was due to improvements in health care (Charlton et al., 1988; Mackenbach et all., 1988).

Concerning children's health, the municipalities running public health care in Finland were already in the mid-1940s obliged to provide comprehensive mother and child care services regardless of the area of residence or ability to pay. Obviously, at least partly, due to these services, the infant mortality rate in Finland is one of the lowest in the world (OECD, 1999; WHO, 1999). Also vaccination coverage has been very good in international comparisons (National Board of Health in Finland, 1989).

2.5.2 Marital status

Studies conducted in other countries have shown that babies of unmarried mothers have a higher mortality risk than those of married mothers. On the basis of figures for the United States, a doubled risk was found (MacDorman and Atkinson, 1999). Marital status is an often included variable in studies infant and perinatal mortality. Infants born to mothers are characterized by lower birth weight and consequently higher mortality risk (Cramer 1987; Frisbie et al. 1997; Hummer et al. 1999; Kallan 1993). Statistics derived from civil registration data (1985-1990) show that with the exception of the Denmark, Iceland, and Sweden, all the European countries have excess late fetal mortality for extra-marital births, the relative risks ranging between 1.3 and 1.9 (except for Spain where it is 2.7). At present the inequality is even greater for late fetal mortality than for infant mortality (Burdan, 1996). At shorter gestation durations (8-20 weeks), unmarried women have risks of fetal mortality double those for married women (Carlson et al., 1999; Gourbin, 2002). In the Netherlands, too, children of a mother without a partner have an above average risk of dying. This situation is common among teenage mothers, and also explains why children of Turkish and Moroccan teenage mothers – who are usually married – are less likely to die than those of Antillean mothers (Achterberg and Kramers, 2001). Only one in fifty Antillean teenage mothers are married at the time they have their baby, and the remainder are mostly single (Garssen, 2004).

This relationship is often attributed to lifestyle differences and a greater likelihood of inadequate familial, social, and/or economic resources among unmarried mothers (Eberstein et al. 1990). That children born out of wedlock and without paternal recognition (illegitimate) suffer high excess mortality has long been known. The increased risk is due to partly to the mother’s social isolation, combined with less favorable economic conditions. This risk persists despite changes in patterns of behavior that have led to a growing number of extra-marital births and greater social acceptance of the phenomenon.

Analyzing perinatal deaths by marital status of mother in this section we test hypothesis that higher mortality risk among babies born for unmarried mothers can be as a result of less favorable social and economic conditions of unmarried mothers in society.

2.6 Research questions and hypotheses

Analyzing risk factors which are available from the national statistics this study will answer to the following questions:

1. Do different level of accessibility and quality of medical services in urban and rural area in Kazakhstan have an impact on perinatal deaths?
2. Do less favorable social and economic conditions of unmarried mother have an effect on perinatal death?

3. Are children at high risk when the mother is at teenage age or over than 35. Does U-shaped relation exist in Kazakhstan?

The issue of rural or urban residence is consistently important in terms of differentials in population growth, socioeconomic status and public health. Urban bias is an often cited characteristic of state socialist regimes. Ideologically focused on workers and economically focused on industry, these regimes have tended to generate systems that concentrate social goods in urban areas. Not surprisingly, the successor states of the former Soviet empire have inherited economic systems that place rural areas at a relative disadvantage.

Despite of successful carrying out of economic reforms, the growth of budgetary provisions on health service, health of the population of Kazakhstan requires significant improvement. The state of health of the countrymen living in remote regions with limited access to qualitative health services calls a serious anxiety.

In Kazakhstan, approximately 46 percent of the population live in a rural area presented by 169 regions with average population density of 2,5 persons on a square kilometer. The general deterioration of the state of health service in the Republic has seriously reflected in rural health service of Kazakhstan for which the great number of problems is typical, such as insufficiently developed infrastructure, isolation, shortage and turnover of the medical personnel, unreliable and expensive system of transportation, the limited access to information sources for medical personnel, necessity for overcoming of huge distances for reception of a specialized medical help, etc.

According to the information of the Ministry of Health Care of the Republic approximately only 90 percent of rural population is covered by medical service.

Workers of rural health service, working in the small, isolated hospitals and ambulatories, have the limited access to the qualified consultations and information resources. Such isolation and limitation on a background of insufficient financing is the reason of the big turnover of staff, typical for rural health service of Kazakhstan.

A study on accessibility and quality of medical services was conducted in 2003 in Kyzylorda, Karaganda, East-Kazakhstan, South-Kazakhstan oblasts, and Astana city. The accessibility of medical services was evaluated taking into account geographic, financial, and organizational factors.

Analysis of the results of the survey showed that the rural population experiences the most difficulties in reaching healthcare facilities, financial accessibility in receiving medical services and in quality of medical care.

The insufficient provision of public transportation is a serious obstacle to receiving necessary medical care, especially for the poor population. The poor functioning of the public transport system, especially in rural areas, decreases access to primary medical care.

Assessing the urban population's financial difficulty in applying for medical care was significantly different from assessing this difficulty for the rural population. According to the survey (2003) respondents in urban areas reported partial difficulties in paying for services in 59.1% of cases, while among the rural population this proportion was 76.7%.

Given the reported level of household income, which averages 70,318 tenge (Kazakh currency, equivalent 470$) a year per household member, it follows that each household pays on average about 7.5% of its income for medical care. As noted before, more vulnerable groups, such as rural residents, low income families, and families with many children, are forced to spend a larger proportion of their incomes on healthcare services.

Per capita calculation showed that direct out-of-pocket payment for medical services was 1,320 tenge per person per year. This is about 25-30% of the total amount of healthcare financing from local budgets in the surveyed oblasts. Although for various reasons (choice of territory, size of sample, methodology) this household study cannot be fully representative of the whole country, its results do raise concern because of the amount of payments and their distribution by region and social group of the population.

One important conclusion is that the main factor defining the amount of direct payment is the patient's condition (the graver it is, the higher the payment). This leads to a very small difference in absolute numbers between regions (except Kyzylorda oblast), urban and rural areas, households with different income levels, and other characteristics. As a result, the poorest households have to spend a larger proportion of their income on medical care. Therefore, solidarity of financing, one of the main goals of the healthcare system has not been achieved, as the poorest population in fact subsidizes those who are better off instead of vice versa.

Assessment of the quality of healthcare services revealed serious problems. The duration of the first consultation and organizational accessibility are important aspects of the quality of primary aid. It is universally accepted that 30 minutes is the minimum amount of time needed for the patient's first consultation. This time covers the collection of information, objective assessment, examination, and determination of future tactics. The recommended duration of the first consultation was observed only in 12% of cases, and in more than a third of cases it lasted less than 15 minutes. A patient's paying capacity is one of the factors that determines the duration of the first contact with the doctor. Among the patients from households with monthly income below 4,000 tenge per person, only in 9.2% of cases were the first consultations in PHC facilities more than 30 minutes in duration. With an income level above 10,000 tenge per person, the proportion was already 15.7%, which also correlated with other aspects of financial accessibility.

Among other findings that indicate problems regarding quality, it is important to note that more than a quarter of patients who needed hospitalization had to wait for more than a week, and of those, 75% had to wait for more than a month. Many patients had to wait a rather long time for the arrival of the ambulance car, and almost 60% of these said they did not receive any medicine from the ambulance staff. The latter fact shows that ambulances are often used merely as a means of transportation, and not as a facility providing professional medical aid.

Thus, the assessment of objective factors revealed serious problems concerning the quality of the medical services provided to the population.

Analyzing accessibility and quality of medical services in urban and rural area we will test hypothesis that higher mortality risk among babies born in rural area can be as a result of the low level of accessibility and quality of medical services.

Unemployment is strongly associated with an increased risk of morbidity and mortality. Unemployed persons use more general health services, have more physical and mental health problems and even have a higher suicide rate than their employed counterparts. The topic of unemployment and pregnancy outcome is of interest for several reasons, since it is a marker of socioeconomic status, a potential marker of stress, an indicator of poor physical or mental health, a proxy for chemical exposures like alcohol or cigarette smoke etc. Much controversy exists in the literature with regard to the influence of unemployment in the family on pregnancy outcome. However, there appears to be consensus that unemployment in pregnancy shows a strong association with social disadvantage, low income, being unmarried and having unfavorable health behaviors. The correlation between unemployment and ill health has been explained as a result of both exposure to these factors and selection of unhealthy persons to be unemployed. The relationship is complex and causation cannot easily be proved.

The economic difficulties after 1991 have reversed some of the accomplishments of the Soviet system on gender issues. The former Soviet Union (FSU) provided protection against gender discrimination. Gender equality of admittance to schools was apparent, female employment was considerable, and substantial benefits were provided for women. Unemployment among women is disproportionately high and those women being still employed earn average wages that are equivalent to only three-quarters of men’s. Single mothers and families with many children, especially in rural areas and small towns, are most affected by the decline in incomes.

Analyzing perinatal deaths by marital status of mother in this section we will test hypothesis that higher mortality risk among babies born for unmarried mothers can be as a result of less favorable social and economic conditions of unmarried mothers.

3. Methodology

3.1 Data availability and quality

3.1.1 Data sources (availability)

The data utilized in the current multidimensional analysis are regularly reported in vital statistics for the Kazakhstan. Live birth, stillbirth and early neonatal death are registered in Civil Acts Register (ZAGS – Zapis ob Actah Grazhdanskogo Sostoyania). For registration of live births and stillbirths in Civil Act Register are presented "Birth certificates" and "Death certificates". A Birth Notification Form (Form 103/y-03) and stillbirth registration form (106-2/y-03) are completed with the parent(s) by Hospital Staff (in the case of hospital births) or by a doctor or midwife (in domiciliary births). This form outlines the information to be recorded in the Register of Births and completed with one, or both parents to ensure that correct and accurate information is registered. This form is forwarded to a registration office to inform the registrar that the birth has occurred.

Births and stillbirths are registered by following characteristics:

Child's Details:

- The time, date and place of the birth of the infant or fetus.
- The gender of the infant or fetus.
- Order of births.
- Weight, maturity, and length of infant or fetus.

Mother's Details

- The forename(s) and surname of the mother
- Place of residence of mother
- The mother's date of birth.
- Nationality of mother.
- Educational attainment of mother. (basic (nachalnoe), secondary (srednee), vocational (teqnikum), university (nezakonchennoe – unfinished), university (vysshee - finished).

- The mother's marital status at the time of the birth. (A person's marital status is either “never married”, “married”).

In the case of stillbirths also are registered followings:

- Time of stillbirths (intranatal, antenatal).
- Causes of stillbirths.

The data are collected by regions and are processed by Central National statistical Office.

Nevertheless, all data by various characteristics of childbearing population are not available in Official Statistics. For the purpose of the study during observation have been used two types of data sources:

1. Published data sources - Demographic Yearbook (Agency of Statistics of the Republic of Kazakhstan).
2. Unpublished data sources (Agency of Statistics of the Republic of Kazakhstan).

The Demographic Yearbook is a comprehensive collection of demographic statistics, prepared by the National Statistical Agency of Kazakhstan. It is published from 2004. The last Demographic Yearbook contains demographic statistics for the period 1999 through 2007. It presents tables of the main statistical indicators that reflect the demographic processes of Kazakhstan and its regions. The Demographic Yearbook contains data about administrative-territorial division, changing the overall size and age structure of the population, its location on the territory of Kazakhstan. It presents time series of population size, age, sex and urban/rural residence, natality, mortality and nuptiality, divorces and migration processes. It also presents generalized demographics indicators that characterize the processes of reproduction of the population of Kazakhstan's regions, total fertility rate, life expectancy at birth.[6]

Unpublished data was taken by the agreement of Charles University in Prague and Statistical agency of Kazakhstan. For the purpose of the study during observation has been used aggregated data are taken from unpublished data sources for the years 1999 through 2008. The reason of using unpublished data was that the Demographic Yearbook does not publish the cross tabulated data on stillbirths and early neonatal deaths by mother’s characteristics. In the published sources the data on live births, stillbirths, and early neonatal deaths are given by the following characteristics:

1. Live births data are published by:
   1) Mother’s age (age groups “<20”, “20-24”, “25-29”, “30-34”, “35-39”, “40-44”, “45-49”, “50+”)
   2) Nested mother’s age and place of residence (“urban” and “rural”)
   3) Nested birth order (from “1” to “7+”) and place of residence

[6] The Demographic Yearbook is available in PDF format in the website of Agency of Statistics of the Republic of Kazakhstan: http://www.stat.kz/publishing/Pages/publications.aspx

4) Cross tabulated mother's age, birth order and place of residence
5) By nationality

2. Stillbirths and early neonatal deaths are published by:
   1) Region

Data are taken from unpublished data sources i.e. number of live births, stillbirths and early neonatal deaths are given by the following characteristics:

1) Sex of child ("boys", "girls").
2) Mother's place of residence: ("urban" and "rural").
3) Mother's marital status (A person's marital status are "married", "unmarried").
4) Child birth order (1, 2, 3, 4, 5, 6, 7+)
5) Mother's age (completed ages 15-50+ and unknown)

The data by various child's and mother's characteristics are not cross tabulated. There are two special dataset, special cross tabulations of live births, stillbirths and early neonatal deaths.

In the first special dataset data are nested or cross tabulated by mother's age, sex, place of residence, and mother's marital status. In the second special dataset data are nested or cross tabulated by mother's age, sex, place of residence, and birth order. There were unknown data (0.5-0.9% from total percentages) for all live birth, stillbirth and early neonatal deaths. In order to eliminate these unknown data there were done some calculations. Unknown data were distributed in all age groups. For distribution of unknown data were calculated percentages for all known data by age of mother. Then the unknown data have been multiplied to all percentages and divided by 100. Then the calculated numbers were added to all number of known cases.

Maternal age was divided into five age groups: <=19 years; 20-24 years; 25-29 years; 30-34 years; over 35 years. The first age group, less than 20 years of age, was used because teenage fertility was not high (there were not enough cases for analysis). The oldest group, an aggregate of all women over 35 years of age, was used because there were not enough cases of perinatal deaths for older women to be statistically valid.

Birth order encompasses the following three categories: first, second, third and higher. During comparison of perinatal mortality rates by birth order there have been found big fluctuations between years over than third birth order. Therefore, in order to eliminate an effect of low numbers this system has been adopted.

3.1.2 Quality and reliability of data

It has been found that the perinatal mortality rate increased during last estimated year (2008). The sharp increase in rate was due to the increase in the number of live births, stillbirths and early neonatal deaths. The reason of increase in the number of live birth and stillbirths was result of the new adopted definitions recommended by World Health Organization. Before adoption of new definitions of live birth and stillbirth, Kazakhstan used old so called “Soviet” definitions of live births and stillbirths. Soviet Union that did not count premature and low birth weight babies who died within seven days as live births during the registration period.

The absence of protocols based on WHO criteria leaded to the following groups of newborns being inadequately accounted for in the official statistics:

- Newborns with birth weights between 500 g and 999 g, born before 28 weeks of pregnancy, if they do not survive the first seven days after birth;
- Newborns with birth weights of 1,000 g or more, born after 28 or more weeks of pregnancy, if they do not manifest breathing.

Newborns of the first group are considered as late miscarriages and are not included in the official statistics, while the newborns of the second group are registered as stillbirths if reanimation proves unsuccessful. This second group is included in perinatal mortality but not in the number of deaths within a year from birth, i.e. in the infant mortality and under-five mortality rate.

Nationwide registration of newborns according to the new criteria started in January 2008 where all newborns weighing 500 grams and more and with 22 weeks of gestation (instead of the 1000 grams and 28 weeks that was required under the former system) were registered as live births when any sign of life is present.

According to WHO fetal death (dead born fetus) is the death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles. Live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live born. The perinatal period commences at 22 completed weeks (154 days) of gestation and ends seven completed days after birth.

The definitions of miscarriage, abortion (induced, unsafe and spontaneous), stillbirth or late-fetal death, viability and live birth are particularly complicated, socially as well as biologically constructed, and subject to variation. This variability will affect the prospects for accurate recording in registration systems, community and hospital surveys, together with those for measurement and comparison. Since the immediate causes of fetal deaths may be difficult to identify, even with the aid of postmortem examinations, the ultimate causes (e.g. maternal physique, infection, poor midwifery) are also likely to be difficult to identify.

The reliability of mortality estimates calculated from prospective and retrospective birth or pregnancy histories collected in community studies depends on the completeness with which births and deaths are reported. Underreporting of infant deaths is usually greater for deaths that occur very early in infancy (Curtis, 1995). In some cultures and societies, a pregnancy loss may never be reported (Blanc, 2000). Completeness and accuracy of recall, including age at death, may deteriorate with time, as in all surveys, and is also related to the skill and cultural sensitivity of the person carrying out the interview.

Underreporting remains a problem, especially with regard to early deaths and stillbirths in particular. Data on stillbirths are less frequently available than data on deaths after birth, and are most prone to underreporting. Stillbirth data are available for fewer countries and are less consistent than early neonatal and neonatal mortality data. In many instances, stillbirths reported in surveys in developing countries accounted for half, or even one third, of the early neonatal deaths, which is counterintuitive, as the same factors causing early neonatal death also come into play before birth. Stillbirths should equal, or more likely exceed, early neonatal deaths, as shown by data from developed countries, historical datasets and hospital data.

Reliability of data depends on reliable reporting and recording of births and deaths. Underreporting and misclassification are common, originating both with the mother and with the recording mechanism. The reason for underreporting may be to avoid a tedious process of registration, particularly in the case of an early death, or it may be due to ignorance of requirements. It can also be related to disincentives, such as having to pay a registration fee, or simply not seeing any obvious benefit. Misclassification of live births and deaths can also occur; there may be misunderstanding of the definition of live birth and fetal death, or misunderstanding of the purpose of reporting. Live births are more likely to be reported than fetal or early neonatal deaths, and nonviable births may systematically be reported as stillbirths (Velkoff and Miller, 1995). A review of studies on underreporting indicates that, while both live births and neonatal deaths may be underreported, fetal deaths are much more likely to go unreported (Greb AE et al., 1987). Moreover, the earlier the gestational age and the lower the birth weight, the less likely it is that birth and death will be reported (Harter et al., 1986).

A number of studies in developed countries show that incomplete reporting of vital events varied between 10% and 30% (Tenovuo et al., 1986; McCarthy et al., 1980). In countries with incomplete reporting or misreporting of vital statistics, underestimation may vary between 20% and 40% (Kleinman, 1986). Comparison between vital statistics and surveys carried out by the Centers for Disease Control (CDC) in some eastern European (Serbanescu et al., 2001) and western Asian (Serbanescu et al., 2003) countries show important underreporting of infant and earlier deaths. In developing countries, there are even greater discrepancies between reporting of vital events and the findings of community studies. For example, only 6% of infant deaths and 62% of births were reported in Cameroon (Ndong et al. 1994) and only 76% of births and 69% of early neonatal deaths of babies weighing over 1500 g were reported in Chile. A study in Kenya showed that, while civil registration underestimated deaths, particularly in the neonatal period, the age distribution of death in children between 1 and 59 months of age was the same as with active surveillance (Arudo et al., 2003). Therefore, while underreporting may occur at all times, the earlier the death, the greater the underreporting. This means that data on stillbirths are less frequently available than data on deaths after birth and are also most prone to underreporting.

3.2 Methods

First, the crude and standardized perinatal death rates were calculated. The crude perinatal mortality was calculated separately for each risk factor: maternal age, mother's place of residence and marital status, child sex and birth order. The association between these risk factors and perinatal deaths was then calculated, expressed as adjusted odds ratios (OR) and 95% confidence interval (CI). The adjusted ORs were obtained using a logistic regression model.

3.2.1 Crude perinatal mortality rate

The simplest and most common measure of perinatal death is perinatal mortality rate. The perinatal mortality rate denotes late fetal and early neonatal deaths divided by the population at risk (all births or live births). However, for the purpose of the present analysis, we consider such a rate as crude and subsequently the rate was standardized for mother's age.

Crude perinatal mortality rate = (Early neonatal deaths + stillbirths) / Total births*1000

Where

Total births = live births + stillbirths.

Early neonatal death is deaths of infants aged 0-6 completed days

Definition of rates: stillbirth, early neonatal, perinatal, postperinatal, and infant mortality rates:

Infant mortality rate – Deaths of infants aged under 1 year per 1,000 live births. The infant mortality rate is the sum of the neonatal and postneonatal mortality rates.

Neonatal mortality rate – Deaths of infants aged 0-27 completed days per 1,000 live births. The neonatal mortality rate is the sum of the early neonatal and late neonatal mortality rates.

Early neonatal mortality rate – Deaths of infants aged 0-6 completed days per 1,000 live births.

Late neonatal mortality rate – Deaths of infants aged 7-27 completed days per 1,000 live births.

Postneonatal mortality rate – Deaths of infants aged 28 days-1 year per 1,000 live births.

Perinatal mortality rate – Late fetal deaths plus early neonatal deaths per 1,000 live births plus stillbirths (per 1,000 births).
Postperinatal mortality rate - Deaths to infants aged 7 days-1 year per 1,000 live births.
Low birthweight rate – Births with weight at delivery of less than 2,500 grams per 100 live births. The low birthweight rate is the sum of the moderately low and very low birthweight rates.
Moderately low birthweight rate – Births with weight at delivery of 1,500-2,499 grams per 100 live births.
Very low birthweight rate – Births with weight at delivery of less than 1,500 grams per 100 live births.
Term – Births at 37-41 weeks of gestation.
Preterm rate – Births at less than 37 completed weeks of gestation per 100 live births. The preterm rate is the sum of the moderately and very preterm rates.
Moderately preterm rate – Births at 32-36 weeks of gestation per 100 live births.
Very preterm rate – Births at less than 32 weeks of gestation per 100 live births.

3.2.2 Rates adjusted for Population Composition

The level of an observed death rate, like that of other observed rates, is affected by the demographic composition of the population for which the rate is calculated. The age composition of the population, in particular, is a key factor affecting the level of the crude deaths rate. For purposes of comparing death rates over time or from area to area, it is useful to determine the difference between the rates on the assumption that there are no differences in age composition. It is particularly important to eliminate the effect of the differences in age structure of two populations being compared if one is trying to compare their health conditions. Crude death rates are especially unsatisfactory for this purpose. A crude death rate of a population may be relatively high merely because the population has a large proportion of persons in the older ages, where death rates are high; or it may be relatively low because the population has a large proportion of children and young adults, where death rates are low. The crude death rate of a country may actually rise even though death rates at each age remain stationary, if the population is getting older.

The procedure of adjustment of the crude rates to eliminate from the effect of differences in population composition with respect to age and other variables is called standardization. Often, death rates are adjusted or standardized for both age and sex. Other variables for which death rates may be adjusted or standardized are racial composition, nativity composition, urban-rural composition, and so on.

Age-adjusted rates can be interpreted as the hypothetical death rate that would have occurred if the observed age specific rates were associated with a population whose age distribution equaled that of the standard population. However, it is important to recognize that age-adjusted or age-standardized rates have no direct meaning in themselves. They are meaningful only in composition with other similarly computed rates. Since they are useful only for comparison, the commonest application of the procedure is to compute such rates for the areas or population groups whose mortality is to be compared and to calculate the relative differences of the resulting rates. The meaningful measure then is a ratio, index, or percentage difference between rates similarly adjusted.

A number of methods have been developed for adjusting death rates for age composition or for deriving indexes or relative measures of age-adjusted mortality. The measures are the age-adjusted or age-standardized death rate calculated by the direct method, the age-adjusted or age-standardized death rate by the indirect method, the comparative mortality index, and the life table death rate.

3.2.3 Direct standardization

The simplest and most straightforward measure is standardized death rate have been derived by the direct method. For most comparisons, this is the preferred procedure and it provides the best basis for determining the relative difference between mortality in two areas. In this method, a "standard" population is selected and employed in deriving all the age-standardized rates in a set to be compared. If the same standard is employed, as required, all the rates are directly comparable. The formula calls for computing the weighted average of the age specific death rates in a given area, using as weights the age distribution of the standard population. The formula for direct standardization is

$$m_1 = \frac{\sum m_a P_a}{P} * 1000 \qquad \text{or} \qquad \sum m_a \frac{P_a}{P} * 1000$$

where $m_a = \frac{D_a}{P_a} =$ age-specific death rate in a given area, P_a represents the standard population at each age, P or $\sum P_a$ represents the total of the standard population. (Capital letters are used here to identify the elements of the population, and lower case letters are used to identify the indicators of the populations under study.) Each age-specific rate is multiplied, in effect, by the proportion of the standard population in each age group. (In standardizing a death rate for age and sex jointly, each age-sex-specific death rate is multiplied by the proportion of the total standard population in that age-sex group.) The age-standardized death rate for the standard population is the same its own crude death rate, since age-specific death rates for the standard population would be weighted by its own population.

3.2.4 Standardized perinatal mortality rate

An example above on rates adjusted for population composition has been given to understand how the age standardized death rate is calculated.

Crude perinatal death rate of childbearing population may be relatively high merely because for example mothers have a low proportion of births at age groups over than 35, where perinatal death rates are high; or it may be relatively low because the mothers have a high proportion of births at age groups 20-24, where perinatal death rates are low. The crude rate may actually rises even though perinatal death rates at each age group of mother remain stationary, if the births increase for mothers over than 35. Different distribution of births at each age groups of mother will have serious impact on perinatal mortality comparisons. These differences in distribution are more sensitive when mortality rate are compared by place of residence and marital status of mother.

In this analysis we confined our discussion largely to standardization for urban-rural and marital status of mother since these are the most important and most common variables for which the standardization of perinatal death rates is carried out. Direct method has been taken as a method for calculation.

In this study, mother's age specific total births of whole Kazakhstan have been used as a standard. The formula for direct standardization is

$$m_1 = \frac{\sum m_a B_a}{B} * 1000$$

where $m_a = \frac{D_a}{B_a}$ = mother's age-specific perinatal death rate in a given area, B_a represents the standard births at each age of mother, B or $\sum B_a$ represents the total of the standard births. Each age-specific rate is multiplied, in effect, by the proportion of the standard births in each age group. In standardizing a perinatal death rate for urban and rural area, each perinatal death rate by place of residence is multiplied by the proportion of the total standard births of whole Kazakhstan. In standardizing a perinatal death rate for urban and rural area and marital status, each perinatal death rate by place of residence and marital status of mother is multiplied by the proportion of the total standard births of whole Kazakhstan.

Illustrative calculations are shown for urban and rural area of Kazakhstan (2008) in Table 3. The total births of Kazakhstan are employed as standard births to calculate standardized perinatal death rate for urban area (2008), and rural area (2008). The steps in calculating the standardized perinatal death rate by the direct method for urban area as follows:

1. Record the births in each age group for Kazakhstan (standard births)
2. Record the mother's age specific perinatal death rates for urban area of Kazakhstan

3. Compute cumulative product of the birth figures in step 1 and the perinatal death rate in step 2 (9809)
4. Divide the result in step 3 (9809) by the total births of Kazakhstan (360373). The result is 27.22 per 1000.

Table 3 - Calculation of maternal age standardized death rates by the direct method, for urban and rural area of Kazakhstan: 2008

Mother's age group	Standard births (B_a) Kazakhstan, 2008	Mother's age specific perinatal death rates (m_a)	
		Urban (2008)	Rural (2008)
<19	23036	0.0336	0.0227
20-24	122239	0.0243	0.0154
25-29	104348	0.0236	0.0144
30-34	67555	0.0283	0.0175
35-39	34512	0.0374	0.0238
40-44	8265	0.0473	0.0312
45+	418	0.0436	0.0255
(1) Total standard births = $\sum B_a = B$	360373	(X)	(X)
(2) Expected deaths = $\sum m_a B_a$	(X)	9809	6185
(3) Age-adjusted death rate = $\frac{\sum m_a B_a}{B} = \frac{(2)}{(1)}$	(X)	27.22	17.16
(4) Percentage differences from Kazakhstan rate [(3)-22.7] / 22.7	(X)	19.9	-24.4
(5) Crude death rate (CDR)	22.7	27.16	17.22
(6) Percentage difference or CDR from Kazakhstan rate [(5)-22.7] / 22.7	(X)	19.6	-24.1

Sources: Unpublished statistical data of Kazakhstan, 2008
Note: birth=live birth + stillbirth
X – not applicable

3.2.5 Logistic regression

The study uses the binary logistic regression model. Logistic regression describes the relationship between a categorical response variable and a set of predictor variables. A categorical response variable can be a binary variable, an ordinal variable or a nominal variable.

Binary responses (for example, success and failure), ordinal responses (for example, normal, mild, and severe), and nominal responses (for example, major TV networks viewed at a certain hour) arise in many fields of study. Logistic regression analysis is often used to investigate the relationship between these discrete responses and a set of explanatory variables. Several texts that discuss logistic regression are Collett (1991), Agresti (1990), Cox and Snell (1989), Hosmer and Lemeshow (2000), and Stokes, Davis, and Koch (2000).

Each type of categorical variables requires different techniques to model its relationship with the predictor variables. It makes use of several predictor variables that may be either numerical or categorical. For example, the probability that a person has a heart attack within a specified time period might be predicted from knowledge of the person's age, sex and body mass index. Logistic regression is used extensively in the medical and social sciences as well as marketing applications such as prediction of a customer's propensity to purchase a product or cease a subscription.

Other names for logistic regression used in various other application areas include logistic model, logit model, and maximum-entropy classifier.

The logistic equation: Logistic regression predicts the log odds of the dependent (odds and odds ratios are explained further below): ln(odds(event)) = ln(prob(event)/prob(nonevent))

$z = b_0 + b_1X_1 + b_2X_2 + ... + b_kX_k$

- where z is the log odds of the dependent variable and
- where b0 is the constant and
- where there are k independent (X) variables, some of which may be interaction terms.
- The "z" is the logit, also called the log odds.
- The "b" terms are the logistic regression coefficients, also called parameter estimates
- Exp(b) = the odds ratio for an independent variable

The odds ratio is the factor by which the independent increases or decreases increases the log odds of the dependent (see discussion of interpreting b parameters below).

- Exp(z) = the odds that the dependent equals the level of interest rather than the reference level. In binary logistic regression, this is usually the odds the dependent = 1 rather than 0.

Thus for a one-independent model, z would equal the constant, plus the b coefficient times the value of X_1, when predicting odds(event) for persons with a particular value of X_1, by default the value "1" for the binary case. If X_1 is a binary (0,1) variable, then $z = X_0$ (that is, the constant) for the "0" group on X_1 and equals the constant plus the b coefficient for the "1" group. To convert the log odds (which is z, which is the logit) back into an odds ratio, the natural logarithmic base e is raised to the zth power: odds(event) = exp(z) = odds the binary dependent is 1 rather than 0. If X_1 is a continuous variable, then z equals the constant plus the b coefficient times the value of X_1. For models with additional independent variables, z is the constant plus the crossproducts of the b coefficients times the values of the X (independent) variables. Exp(z) is the log odds of the dependent, or the estimate of odds(event).

Dependent variable: In binary logistic regression, the dependent variable is dichotomous in nature. For the binary logistic, regression dependent variables are in two categories. Usually we predict the higher category (assumed as 1) by taking the lower reference category (assumed as 0). In multinomial logistic regression, the dependent variable has more than two categories. We can predict the other category by the reference category. In ordinal logistic regression, we predict the cumulative probability of the dependent variable order.

Factor: The independent variable in logistic regression is dichotomous in nature and is called the factor. Therefore we convert a categorical variable into a dummy variable.

Covariate: The independent variable that is metric in nature is called the covariate.

Interaction term: The covariate shows the individual effect on the dependent variable. The interaction effect is the combination of two variable effects on the dependent variable. For example, when we predict the dependent variable based upon age and education category, there will be two impacts: one is individual impact on the dependent variable and the other is the interaction impact.

The study uses the binary logistic regression technique i.e. logistic regression is used in order to predict a binary dependent variable (perinatal death or survival of 7th day) from a set of independent variables (mother's age, mother's place of residence, mother's marital status, and birth order).

In logistic regression the parameters of the model are estimated using the maximum-likelihood method.

Maximum likelihood estimation: This method is used in logistic regression to predict the odd ratio for the dependent variable. In OLS estimation, we minimize the error sum of the square distance, but in maximum likelihood estimation, we maximize the log likelihood.

The statistics used for the interpretation are: estimated odds ratio [exp(B)], confidence interval for exp(B) and the level of significance. The main effect (no interaction) logistic model was utilized. This model estimates the independent effects of each factor while controlling for the others. The logistic model has the form:

$$\textbf{P(perinatal death=1}|\, X_1, X_2, \ldots X_k) = 1/[1+e^{-(A+\sum B_i * X_i)}]$$

where the conditional probability of infant dying equals logistic function with unknown parameters A (intercept) and Bi (slope parameters).

Logistic regression produces odds ratios (O.R.) associated with each predictor value. The "odds" of an event is defined as the probability of the outcome event occurring divided by the probability of the event not occurring. In general, the "odds ratio" is one set of odds divided by another. The odds ratio for a predictor is defined as the relative amount by which the odds of the outcome increase (O.R. greater than 1.0) or decrease (O.R. less than 1.0) when the value of the predictor variable is increased by 1.0 units. In other words, (odds for PV+1) / (odds for PV) where PV is the value of the predictor variable. In order to show practical importance of odds ratio (OR) and confidence limit (95% CL) reference category have been used. Each factor has as many parameters as categories, but one is redundant, so we need to specify reference category. Reference category is used for identification of the statistical significance of the one given parameter. For example, in the thesis are analyzed such factor as marital status of mother. This factor has two parameters: 1-married and 2-unmarried. In SAS software you can specify the value (formatted if a format is applied) of the reference category in quotes or you can specify one of the following keywords. FIRST- designates the first ordered category as the reference; and LAST - designates the last ordered category as the reference. For example in PROC LOGISTIC DATA (SAS Software) the outcome will be looked as follows:

```
PROC LOGISTIC DATA=Marital_stat/<options>;
CLASS Marstat/param=ref  ref=FIRST;
MODEL per_deaths/liveB_early_neonatalD=Marstat/<options>;
RUN;
```

or in the MODEL statement of the PROC LOGISTIC DATA we can also specify the comparison group by using the *ref* = option after the variable name.

```
PROC LOGISTIC DATA=Marital_stat/<options>;
CLASS Marstat (ref='married') /param=ref;
MODEL per_deaths/liveB_early_neonatalD=Marstat/<options>;
RUN;
```

Six models were considered. The first model includes year, mother's place of residence, mother's marital status, and mother's age group independent factors/variables. Second model contains year, mother's place of residence, parity, and mother's age. Difference between these two models is regarding the two independent variables. In the first model independent variables as mother's age and mother's place of residence was combined with mother's marital status while in the second model same variables were combined with child's birth order. The models have dependent (dichotomous) variables: perinatal deaths/survival up to 7^{th} day (live births-early neonatal deaths). These first two models include years (1999-2008) while next two models (see tables 7 & 8) include the dependent and independent variables in the same order as in the previous two models, but without the observed period. This exclusion in observed years has been done in order to eliminate an effect of new adopted definitions (2008). If two previous models consider period 1999-2008 then next two models consider period 1999-2007. Last (fifth & sixth) models (tables 9 & 10) include dependent and independent variables except year.

3.2.6 Model perinatal deaths/survival up to 7th day (live births-early neonatal deaths) or events/trials

The MODEL statement in the SAS procedure names the response variable and the explanatory effects, including covariates, main effects, interactions, and nested effects. If you omit the explanatory effects, the procedure fits an intercept-only model. MODEL options can be specified after a slash (/).

Two forms of the MODEL statement can be specified. The first form, referred to as single-trial syntax, is applicable to binary, ordinal, and nominal response data. The second form, referred to as *events/trials* syntax, is restricted to the case of binary response data. The single-trial syntax is used when each observation in the DATA= data set contains information on only a single trial, for instance, a single subject in an experiment. When each observation contains information on multiple binary-response trials, such as the counts of the number of subjects observed and the number responding, then *events/trials* syntax can be used.

In the *events/trials* syntax, you specify two variables that contain count data for a binomial experiment. These two variables are separated by a slash. The value of the first variable, *events*, is the number of positive responses (or events). The value of the second variable, *trials*, is the number of trials. The values of both *events* and (*trials-events*) must be nonnegative and the value of *trials* must be positive for the response to be valid.

In the *single-trial* syntax, you specify one variable (on the left side of the equal sign) as the response variable. This variable can be character or numeric. Options specific to the response variable can be specified immediately after the response variable with a pair of parentheses around them.

For both forms of the MODEL statement, explanatory *effects* follow the equal sign. Variables can be either continuous or classification variables. Classification variables can be character or numeric, and they must be declared in the CLASS statement. When an effect is a classification variable, the procedure enters a set of coded columns into the design matrix instead of directly entering a single column containing the values of the variable.

All analyses concerning logistic regression were carried out using the SAS (*Statistical Analysis System)* Software.

4. Results

4.1 Levels and trends in perinatal and infant mortality in Kazakhstan

This chapter presents levels, trends, and differentials of perinatal mortality in Kazakhstan. Since the early 1990s, as a result of political independence, economic and social conditions in several republics of the former Soviet Union, including Kazakhstan, have fluctuated drastically.

Following independence on December 16th, 1991, Kazakhstan's economy contracted by more than 50%, in part due to the loss of approximately 8% of pre-independence GDP that came from transfers from the central Soviet government (Falkingham et al., 1997), as well as a loss of trading partners from the former Soviet Union and the effects of transitioning from a centrally-planned to a rudimentary market economy. This collapse of economic output has had negative effects on population health indicators throughout Central Asia, such as lowered life expectancy and rising adult and infant mortality rates. Although the macroeconomic situation has stabilized, with inflation falling and the economy growing once again, the short- and long-term consequences for individual health and welfare are not well documented.

Table 4 shows stillbirth, early neonatal, perinatal, postperinatal, and infant mortality rates. For the period 1999 through 2008 we can observe that the rates have increased during the last year. The infant mortality rate is 20.5‰ per 1,000 live births. The estimate of perinatal mortality is higher. Stillbirth rate 10.5‰ per 1000 births and early neonatal mortality rate is 12.3‰. According to this table we can see that the perinatal mortality rate is among the highest estimates.

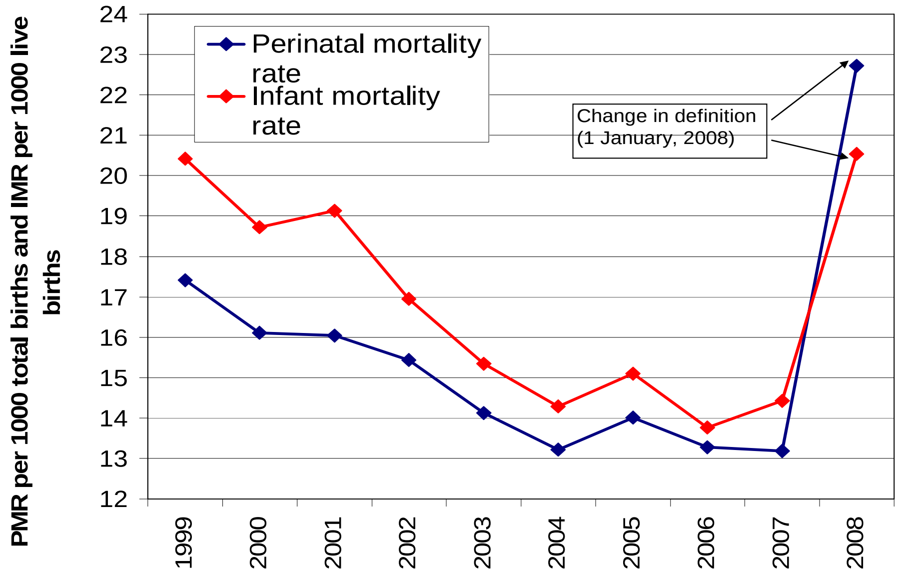
Table 4 - Mortality rates (in ‰) up to the first birthday of a child in Kazakhstan, 1999-2008

Rates	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Stillbirth rate	8.7	8.1	7.7	7.6	7.1	6.3	6.7	6.5	6.5	10.5
Early neonatal mortality rate	8.8	8.1	8.4	7.9	7.1	7.0	7.4	6.8	6.7	12.3
Perinatal mortality rate	17.4	16.1	16.0	15.4	14.1	13.2	14.0	13.3	13.2	22.7
Postperinatal mortality rate	11.6	10.6	10.7	9.1	8.3	7.3	7.7	7.0	7.7	8.2
Infant mortality rate	20.4	18.7	19.1	16.9	15.4	14.3	15.1	13.8	14.4	20.5

Sources: Data from official statistics, own calculation, 2008
Note: Stillbirth rate is the number of stillbirths per 1000 total births, total births =live births + stillbirths
Early neonatal mortality rate is the number of early neonatal deaths per 1000 live births
Perinatal mortality rate is the number of stillbirths plus early neonatal deaths per 1000 total births
Post perinatal mortality rate is the number post late neonatal and postneonatal deaths per 1000 live births

Nevertheless, comparing mortality rates by years it has been found that the rates during the last year (2008) have increased. Comparing with previous years the rates were doubled. Official national statistics indicate that after rising to 17.4‰ in 1999, the perinatal mortality rate continuously decreased and in 2007 was 13.2‰. Early neonatal death was 6.7‰ and stillbirth rate was 6.5‰ in 2007. However, the perinatal mortality rate increased sharply to 22.7‰, early neonatal mortality rate to 12.3‰ and stillbirth rate to 10.5‰ in 2008. Figure 4 presents trends on infant and perinatal mortality rates.

Figure 4 – Trends in perinatal and infant mortality rates (in ‰) in Kazakhstan, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

The reason of the changes in infant and perinatal mortality rates in 2008 was the definitions of «viability», «live birth», and «stillbirth» recommended by WHO which was adopted in 1 January, 2008. If an infant is not considered to be born alive, then he or she cannot be considered to have died. Thus, the definition of “live birth” and “stillbirth” are one crucial determinant of the perinatal mortality rates.

4.2 Demographic differentials in perinatal mortality

Table 4.1 presents perinatal mortality rates by demographic characteristics (i.e., sex of child, mother’s age at birth, and birth order. Mortality rates are generally higher for boys than for girls. There are significant differences in mortality risks associated with mother’s age and birth order. Higher rate is observed at age group over than 35 ages. Crude perinatal mortality rate is relative high among infants of primaparas, lower in children second and third or later in order.

Table 4.1 - Crude perinatal mortality rates (in ‰) by demographic characteristics, 1999-2008

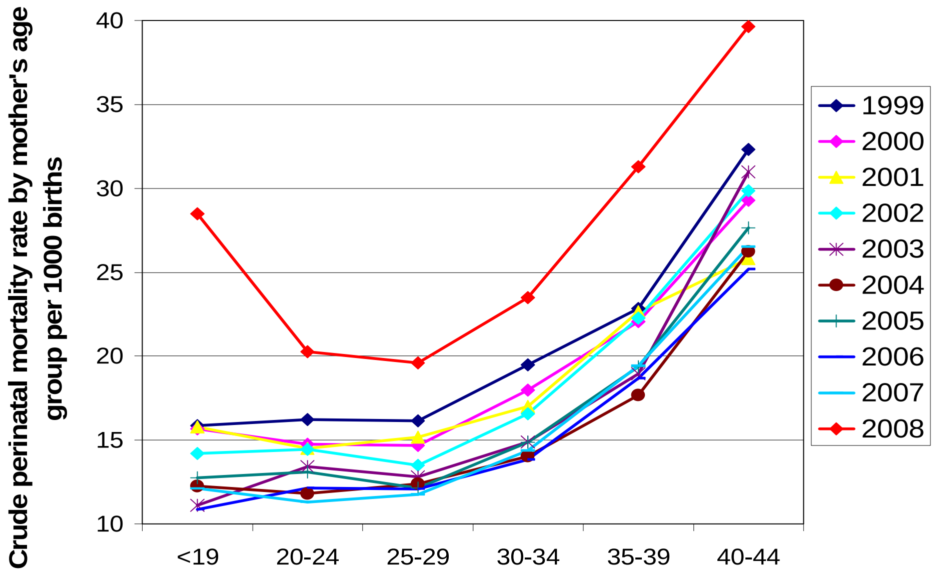
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Sex										
Boys	19.6	18.1	18.0	17.2	15.5	14.6	14.9	14.5	14.8	24.7
Girls	15.1	14.0	14.0	13.6	12.7	11.8	13.0	12.0	11.4	20.6
Mother's age										
<19	15.9	15.7	15.8	14.2	11.1	12.3	12.7	10.9	12.1	28.5
20-24	16.2	14.7	14.5	14.4	13.4	11.8	13.1	12.1	11.3	20.3
25-29	16.1	14.7	15.2	13.5	12.8	12.4	12.1	12.1	11.7	19.6
30-34	19.5	18.0	17.0	16.6	14.9	14.0	14.9	13.8	14.4	23.5
35+	24.5	23.2	23.0	23.7	21.2	19.3	21.2	20.1	20.8	32.9
Birth order										
1-st	18.8	17.8	17.0	16.2	14.9	14.9	16.4	15.4	14.9	24.4
2-nd	15.4	13.7	13.4	12.9	12.0	11.1	11.5	10.9	10.8	19.9
3+	17.3	15.9	17.2	17.0	15.2	12.9	13.0	12.5	12.9	22.8

Sources: Unpublished statistical data of Kazakhstan. 2008

4.2.1 Mother’s age

Among other things, perinatal mortality correlates with the age of the mother, but this is not a linear relationship. Research into the link between perinatal mortality and mother’s age shows U- and J-shaped relations, with the highest risks for babies of very young and relatively old mothers.

Figure 4.1 - Crude perinatal mortality rates (in ‰) by age of mother, 1999-2008



Sources: Unpublished statistical data of Kazakhstan. 2008

The above-mentioned U-shaped relation between mother's age and perinatal mortality is particularly observed in 2008 (Figure 4.1). This relation was according to new adopted definitions. In other years J-shaped relationship is observed. As was expected perinatal deaths occurred more often at higher ages. Except 2008, since 1999 perinatal mortality has fallen across the board, but the age pattern largely remains unchanged. Today the risk is lowest for mothers aged between 20 and 25 years, with relatively small differences between the age groups. It was expected that mortality rate will be high at teenage age. But, according to unpublished data we can observe that the high perinatal mortality rate by age group of mother is significant at higher ages. Except last year, during whole observed period we can observe that perinatal mortality rate is in low level at teenage age.

Although the number of women aged over 40 who have a baby has increased in recent years, these are almost exclusively women between 40 and 44 years. The number of babies born to women aged 45 and older is very small. In 2002 only one in a thousand newborn babies had a mother aged 45 or older. For this reason Figure 1.5 does not give a mortality rate for these babies in the more recent periods.

Women who give birth after 40 run a greater risk of experiencing pregnancy complications than younger women. Moreover, there is an increased risk of the child dying in the womb or in close connection with delivery.

Unlike younger mothers, for older mothers physiological reasons likely play an important role in perinatal mortality (Van Enk et al., 2000). According to Ministry of Health of Kazakhstan (2002) health status of mothers of children who died determines the early deaths of children, as most diseases of pregnant women that increase the risk of maternal mortality also negatively influence the fetus and the newborn. These diseases include anemia – found in 74.7% of mothers, other hematological diseases – 11.0%, endocrine disorders – 5.3%, urinogenital infections – 41.8% and respiratory disorders – 28.2%. Malnutrition was registered with 8% of mothers, while for the remaining 92% nutrition information was not available.

Other factors, such as an unfavorable socio-economic position, the absence of a partner, a lack of social support play also an important role in this age group (Garssen & Meulen, 2004).

The new Labour Law (1 January 2000) forbids any discrimination in the sphere of labour relations, including on grounds of gender. However, Article 17 of the current Law on Labour Protection, adopted by the Supreme Council in 1993, actually obliges employers to apply unequal criteria upon employment of men and women: “All women as well as persons under 18 years are to be hired only after a prior medical examination, and women up to the age of 40, and (minors) up to the age of 18 must undergo a medical examination annually.”

With the growth of competition for work places, discriminatory tendencies in terms of the employment and dismissal of women, particularly regarding women with young children and women over 40 years of age, are increasing. As a rule, women are more likely to be dismissed from jobs than men, and are less likely to be hired. Data from the Almaty employment service shows that women over 40 years old are the least likely to obtain work.

Nevertheless, except fact that perinatal mortality rate remain still high at ages over than 35 it is essential to note that the distribution of perinatal deaths by age of mother has also slightly changed. Table 4.2 presents proportionally distributed perinatal deaths over the age groups of mother. Perinatal deaths have slightly decreased at age groups 20-24 while deaths have increased at higher age groups.

Maternal age specific perinatal death rates by marital status and place of residence show same trends as a total trend. U-shaped relation is observed only during last observed year. All figures related to maternal age specific deaths rates by marital status and place of residence are in Annex 1.

Table 4.2 - Percentage of perinatal deaths over the age groups of mother, 1999-2008

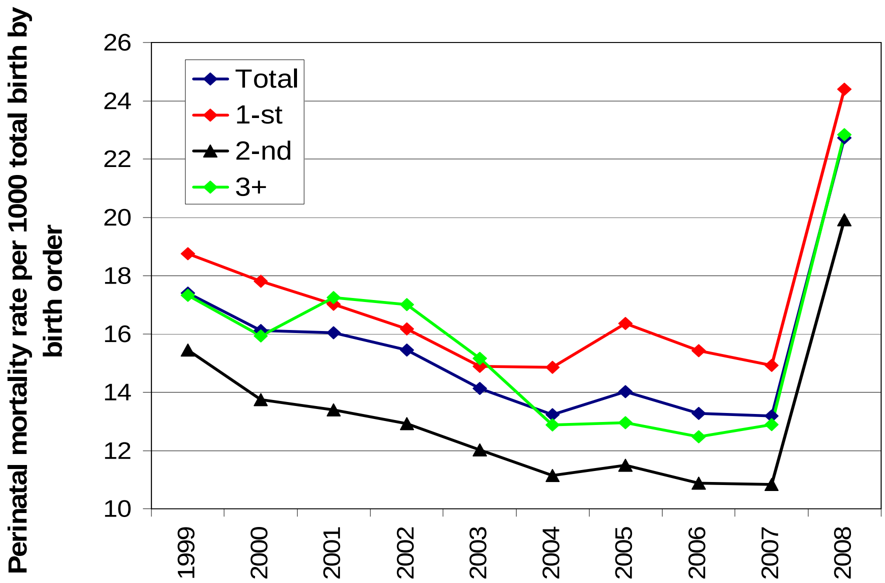
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
<19	9	9	9	8	6	7	7	6	6	8
20-24	36	34	33	34	34	31	32	31	29	30
25-29	25	25	27	25	26	27	25	26	26	25
30-34	17	18	17	18	18	19	19	19	20	19
35+	13	13	14	15	16	16	17	18	19	17
Total	100	100	100	100	100	100	100	100	100	100

Sources: Unpublished statistical data of Kazakhstan, 2008

4.2.2 Birth order

Maternal age needs to be analyzed jointly with parity (child birth order) because the chances of adverse pregnancy outcomes are greater for primiparas 30 years of age and over and multiparas under 18 years of age. Maternal age and parity are closely related demographic factors. They are commonly included in obstetric care records because of their influences on pregnancy complications and outcomes. In clinical practice, both older nulliparous and younger multiparous women are considered to be at increased risk of adverse pregnancy outcomes. Studies have demonstrated that the association of maternal age with outcomes, including placenta previa and abruptio placentae (Ananth et al., 1996) and neonatal mortality, (Kiely et al., 1986) varies significantly by parity.

Figure 4.2 - Crude perinatal mortality rates (in ‰) by child birth order, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 4.2 presents crude perinatal mortality rates by birth order from 1999 through 2008. At the figure above we can observe that first born baby is at higher risk. Nevertheless, analyzing crude perinatal mortality rates by birth order in urban and rural area it have been found that risks by parity are different in both areas. If first born baby is at higher risk in rural area then third born baby at higher risk can be found in urban area (see Annex 2).

Table 4.3 presents proportionally distributed perinatal deaths by birth order.

Table 4.3 - Percentage of perinatal deaths by birth order, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1-st	48	49	47	45	46	48	51	50	49	48
2-nd	26	25	24	25	25	25	24	24	23	24
3+	26	26	29	30	29	27	25	27	28	28
Total	100	100	100	100	100	100	100	100	100	100

Sources: Unpublished statistical data of Kazakhstan, 2008

Analyzing perinatal mortality rate by parity and mother's age we have found J-shaped relations in both areas (see Annex 3).

Standardizing perinatal mortality rate for age of mother by child birth order we have found that the rate is high for first born child as in the case of crude perinatal mortality rate for whole Kazakhstan (table 4.4).

Table 4.4 - Standardized perinatal mortality rate (in ‰) for age of mother by child birth order for whole Kazakhstan, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1-st	21.0	20.3	18.3	17.5	16.3	16.6	19.0	17.9	17.7	26.3
2-nd	15.7	14.3	13.6	13.5	12.7	11.6	12.2	11.6	11.3	21.4
3+	16.3	13.6	14.8	14.6	13.2	9.9	11.2	10.0	10.9	21.6

Sources: Unpublished statistical data of Kazakhstan, 2008

4.3 Social differentials in perinatal mortality

Mortality differentials by mother's place of residence and marital status are presented in Table 4.5. For a sufficient number of births to study mortality differentials across population subgroups, crude perinatal mortality rates are presented for the period 1999 through 2008. At the table below (4.5) we can observe that perinatal mortality rates are lower in rural than in urban areas during whole observed period. Perinatal mortality rate is higher for unmarried mothers.

4.2.1 Mother's place of residence

Figure 4.3 shows trend in perinatal mortality in urban and rural area.

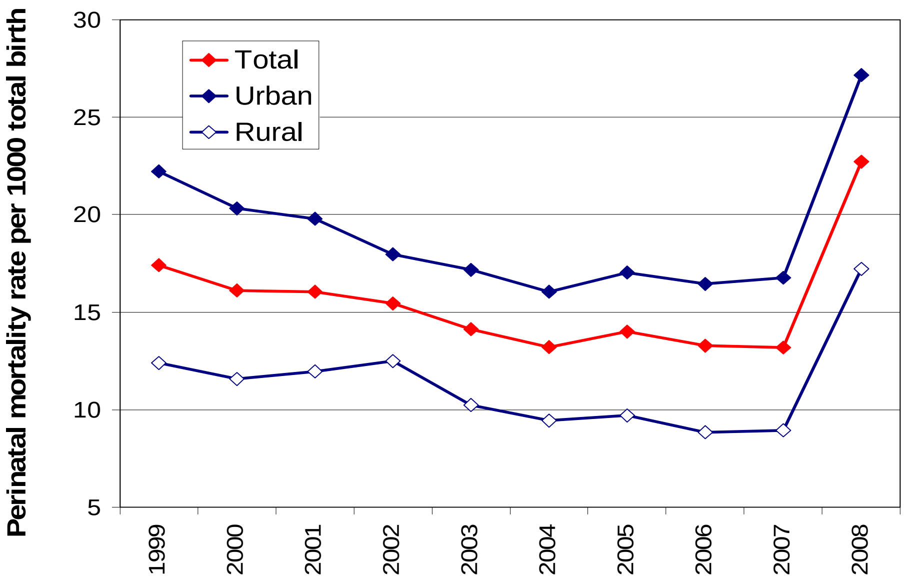
Table 4.5 - Perinatal mortality indicators by social characteristics, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Perinatal mortality rate per 1000 births										
Place of residence										
Urban	22.2	20.3	19.8	18.0	17.2	16.1	17.0	16.4	16.8	27.2
Rural	12.4	11.6	12.0	12.5	10.2	9.4	9.7	8.8	8.9	17.2
Mother's marital status										
Married	10.1	9.1	8.3	8.2	8.8	8.1	8.4	8.0	7.2	12.9
Unmarried	40.3	37.4	38.7	36.2	30.0	28.6	31.3	31.1	35.2	58.7

					Live births					
Place of residence										
Urban	110879	114994	115441	122359	138867	155997	163952	175582	174343	196839
Rural	106699	107060	106046	104812	109079	117031	115025	126174	147620	159736
Marital status										
Married	165619	167653	165240	168608	186515	205024	210922	233399	254141	281195
Unmarried	51959	54401	56247	58563	61430	68004	68055	68357	67822	75380
					Stillbirths					
Place of residence										
Urban	1201	1150	1061	1050	1169	1196	1324	1416	1443	2509
Rural	698	662	658	698	599	533	558	571	669	1289
Marital status										
Married	942	898	846	828	892	800	872	974	965	1887
Unmarried	957	914	873	920	876	929	1010	1013	1147	1911
					Early neonatal deaths					
Place of residence										
Urban	1288	1210	1244	1168	1235	1327	1490	1495	1506	2905
Rural	634	586	618	619	524	577	563	550	655	1484
Marital status										
Married	744	641	526	556	764	861	904	898	881	1764
Unmarried	1178	1155	1336	1231	995	1043	1149	1147	1280	2625

Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 4.3 - Crude perinatal mortality rates (in ‰) by mother's place of residence, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008
Note: Total is the crude perinatal mortality rate for whole Kazakhstan

The number of births has increased in both areas during observed period. Nevertheless, saying in percentage, the proportion of urban births has increased more when compared with rural births. If, at the beginning of the observed period the share of births was 51% in urban area and 49% in rural area then the share of births has slightly changed during last year (55% in urban area and 45% in rural area). The situation in perinatal deaths is not significant as in births. Only during last year we can observe that according to new adopted definition number of cases have doubled in both areas. However, it is essential to note that the share of perinatal deaths is higher in urban area. In 2008 the proportion of perinatal deaths was 66% in urban area (see table 4.6).

Table 4.6 - Percentage of births and perinatal deaths in urban and rural area, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Births										
Urban	51	52	52	54	56	57	59	58	54	55
Rural	49	48	48	46	44	43	41	42	46	45
Perinatal deaths										
Urban	65	65	64	63	68	69	72	72	69	66
Rural	35	35	36	37	32	31	28	28	31	34

Sources: Unpublished statistical data of Kazakhstan, 2008
Note: Births is number of live birth plus stillbirth, perinatal death is number stillbirth plus early neonatal death.

Because of different distribution of births and perinatal deaths during whole observed period in both areas it have been calculated standardized perinatal mortality rates for mother's age. Table 4.7 presents standardized calculations.

Table 4.7 - Standardized perinatal mortality rates (in ‰) for mother's age by place of residence, 1999-2008,

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Urban	22.2	20.3	19.8	18.0	17.2	16.0	17.0	16.4	16.8	27.2
Rural	12.4	11.6	12.0	12.5	10.2	9.5	9.7	8.8	8.9	17.2

Sources: Unpublished statistical data of Kazakhstan, 2009

After standardization of perinatal mortality rates in both areas we assumed that the rate is lower in urban area. We have hypothesized that the high level of accessibility and quality of medical care in urban area can be main reason of the low level of perinatal deaths. However, example above shows that the higher level of accessibility and quality of medical services in urban area with comparison rural area do not give us clear picture. Because perinatal mortality rate is higher in urban area even with the higher level of accessibility and quality of medical services. The reason of the higher level of perinatal deaths in urban area can be explained by other factors. Except fact, that the situation on medicine still remains in worst position in rural area, however, the level of perinatal deaths remain lower in rural area than in urban area.

Other factors, such as previous fetal deaths, previous induced abortions, sexually transmitted diseases, marital status (unmarried), behavioral factors as alcohol and smoking can be one of the reasons of high level of perinatal mortality. The mentioned factors can be more frequent in urban area than in rural area. Historically, population in rural area of Kazakhstan is more traditional than those in urban area. Use of contraceptive methods, abortions, alcohol and smoking is more frequent among urban population than rural.

Most studies show that in the countries where induced abortion is legal, carrying out an induced abortion does not increase the risk of fetal death in subsequent pregnancies (Frank at al., 1991; Chung et al., 1982), except however in the countries where traumatic techniques are in use (WHO, 1979; Kline et al., 1978). The risks described in the latter case were thus due to the methods used to perform this intervention, the problem being especially acute in countries which had legalized induced abortion very early (at the end of the 1950s).

Induced abortion as a means of fertility control has a long history in the republics of the former Soviet Union. Kazakhstan, known prior to 1992 as the Kazakh Soviet Socialist Republic, was subject to the abortion legislation and regulations of the former Union of Soviet Socialist Republics. As a result, abortion practices in Kazakhstan were similar to those throughout the former USSR. The description given below pertains to the situation in Kazakhstan prior to independence. There has been no change in the abortion law since independence.

The Soviet Decree of 27 June 1936 prohibited the performance of abortions except in cases of danger to life, serious threat to health, or the existence of a serious disease that could be inherited from the parents. The abortion had to be performed in a hospital or maternity home. Physicians who performed abortions outside a hospital or without the presence of one of these indications were subject to one to two years' imprisonment. If the abortion was performed under unsanitary conditions or by a person with no special medical education, the penalty was no less than three years' imprisonment. A person who induced a woman to have an abortion was subject to two years' imprisonment. A pregnant woman who underwent an abortion was subject to a reprimand and the payment of a fine of up to 300 roubles in the case of a repeat offence.

In its Decree of 23 November 1955, the Government of the former USSR repealed the general prohibition on the performance of abortions contained in the 1936 Decree. Other regulations issued in 1955 specified that abortions could be performed freely during the first 12 weeks of pregnancy if no contraindication existed and after that point when the continuance of the pregnancy and the birth would harm the mother (interpreted to include foetal handicap). The abortion had to be performed in a hospital by a physician and, unless performed in cases of a threat to the mother's health, a fee was charged. Persons who performed an abortion illegally were subject to criminal penalties established by criminal laws under the Criminal Code. For example, if the abortion was not performed in a hospital, a penalty of up to one year's imprisonment could be imposed, and if it was performed by a person without an advanced medical degree, a penalty of up to two years' imprisonment was possible. In the case of repeat offences or the death or serious injury of the pregnant woman, a higher penalty of up to eight years' imprisonment could be imposed. A woman who underwent an illegal abortion was not penalized.

Despite the approval of the 1955 Decree and regulations, the problem of illegal abortions did not entirely disappear in the former Soviet Union. This situation was due partly to the Government's conflicted attitude towards contraception. Although at times the Government manifested support for contraception, it did little to make contraception available and in 1974 effectively banned the widespread use of oral contraceptives. The situation was also in part the result of a revived pronatalist approach to childbearing adopted at times by the Government, which looked unfavourably on abortion. The result was a reliance on abortion as the primary method of family planning.

Concerned with the high rate of illegal abortions, the Government in 1982 issued a decree allowing abortions for health reasons to be performed through the twenty-eighth week of pregnancy. Continuing this approach of increasing the circumstances under which legal abortions were available, on 31 December 1987 it issued an order setting out a broad range of non-medical indications for abortions performed on request through the twenty-eighth week of pregnancy. These included the death of the husband during pregnancy; imprisonment of the pregnant woman or her husband; deprivation of maternity rights; multiparity (the number of children exceeds five); divorce during pregnancy; pregnancy following rape; and child disability in the family. Moreover, the order provided that, with the approval of a commission, an abortion could be performed on any other grounds.

This extension of the grounds for abortion after the first 12 weeks of pregnancy, combined with the ambivalent attitude of the Government towards contraception, led to a dramatic increase in the number of officially reported abortions. Other factors resulting in a high incidence of abortion have included shortages of high-quality modern contraceptives and reliance upon less reliable traditional methods; a lack of knowledge among couples of contraception and of the detrimental health consequences of frequent abortions; and the absence of adequate training for physicians, nurses, teachers and other specialists.

The 1990s were a period of substantial social stress in Kazakhstan. The female population in particular became increasingly unhealthy and continued to rely on abortion rather than contraception as a primary method of fertility control. According to Ministry of Health of Kazakhstan in 1993 abortion rate estimates were 50 per 1,000 women of fertile age, a very high figure even though it marked a substantial drop from the 1992 abortion rate of 60 per 1,000 women. In the same one-year period, the modern contraceptive rate increased from 27 per cent to 35 per cent, and to 46 per cent by 1995. Under Order 33 of February 1994, a family planning program was approved and all medical institutions were required to provide and massively expand family planning services so as to reduce abortions and maternal mortality.

Induced abortion is one of the greatest human rights dilemmas of our time. The need for scientific and objective information on the matter is therefore imperative. However, because of the sensitive nature of the topic, data sources are limited and accurate information on the occurrence of induced abortion is difficult to obtain.

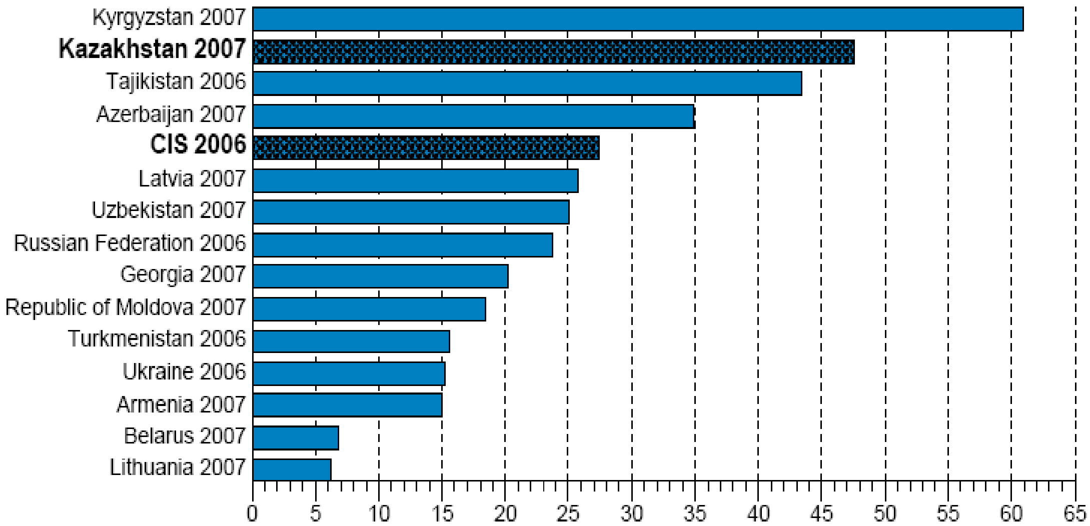
The distinction between safe and unsafe abortion is crucial because each has different public-health implications. Safe abortion has few health consequences, whereas unsafe abortions are a threat to women's health and survival (Henshaw et al., 1999). WHO is involved in efforts to improve maternal health and reduce maternal mortality in 63 priority countries (WHO, 2005). The UN Millennium Development Goals, adopted by 189 nations, include the goal of improving maternal health and the specific target of reducing the maternal mortality ratio by three-quarters between 1990 and 2015 (WHO, 1992). Unsafe abortion is a major cause of maternal mortality, and measuring its incidence is important for monitoring progress on this goal. Unsafe abortion also has other consequences, including economic costs to health systems and families, stigmatisation, and psychosocial effects on women.

Induced abortion can adversely affect a woman's health, reduce her chances for further childbearing, and contribute to maternal and perinatal mortality. According to the findings from the 1999 Kazakhstan Demographic and Health Survey (KDHS), approximately 22% of maternal deaths are associated with this practice.

"***Maternal death*** is the death of a woman due to pregnancy (regardless of its localization and duration). Maternal death occurs during pregnancy or within 42 hours after its termination. The causes of maternal death are related to pregnancy or aggravated by it or its management, but do not include accidents. Maternal deaths are divided in two groups: 1) those that are directly related to obstetric causes, and 2) those that are indirectly related to obstetric reasons (caused by previously existent diseases or diseases that emerged during pregnancy, not related to obstetric reasons, but aggravated by the physiological impact of pregnancy)" (Millennium Development Goals (MDG) in Kazakhstan, WHO report, 2005).

Maternal death is primarily the problem of developing countries. According to WHO report (2005) Kazakhstan does not fall under this category, and yet, judging by the maternal mortality indicator, it can hardly be considered a developed country either. The current maternal mortality rate in Kazakhstan is close to the rates registered in EU countries, the USA, and Japan in the mid-1970s, and significantly exceeds the rates of many former socialist countries (WHO, 2005). According to the data taken from European HFA Database, at the figure 4.4 we compared maternal mortality ratio in former Soviet countries. At the figure we can observe that maternal mortality ratio is highest in Kazakhstan.

Figure - 4.4 Maternal mortality ratio per 100 000 live births, latest available data



Source: WHO/Europe, European HFA Database, January 2009

Note: The *maternal mortality ratio* is the number of women who die from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, per 100,000 live births (WHO,2005).

Information about induced abortion was collected in the reproductive section of the Women's Questionnaire for the 1999 Kazakhstan Demographic and Health Survey in both urban and rural areas. Data revealed that women in all groups use induced abortion as a means of fertility control, but the extent to which they do so varies substantially. According to KDHS (1999) overall, 40 percent of women have had an induced abortion. Of these, 64 percent have had more than one induced abortion. The rate of multiple abortions increases with women’s age. Among women 35 years old or older who have had an induced abortion, 78 percent have had more than one. Among these, the mean number of abortions is 3.6 per woman, and 14 percent have had six or more. According to the KDHS (1999) women in urban areas are more likely to use induced abortion (22 percent) than women in rural areas (9 percent).

Living in an urban area was consistently significant with a strong positive affect on the number of abortions a woman. This is also consistent with the prior findings of KDHS (1999) that living in an urban area had a positive affect on propensity of a woman to have more than one abortion. Women in urban areas are more likely to have access to healthcare facilities that will perform legal abortions. According to the WHO report (2005) the most accessible services in reproductive health were postnatal care (80.5%) and obstetric services (76.9%). Notably, only 63.5% of respondents found antenatal care accessible, with urban respondents finding it even less so than rural respondents (62.1% and 65.3%, respectively). The urban population has better access to other types of services. For example, 72.2% of women in the cities have access to abortion services versus 45.6% in rural areas, to diagnosis and treatment of gynaecological disorders – 79% and 62.1%, respectively, and family planning consultations – 61.6% and 48.4%, respectively. The least accessible services were those providing treatment for sexually transmitted infections (STI) – 48.1% (59.1% in the cities and 33.6% in rural areas) and sterility treatment – 41.3% (52.2% in urban and 26.9% in rural areas).

Alcohol use, drug use, and exposure to environmental agents by pregnant women can be harmful to the developing fetus, with many known short- and long-term effects on organ development, somatic growth, and neurodevelopment. As more families turn to medical providers for consultation before adoption, the challenge of accurately identifying risk factors for poor medical or cognitive outcomes becomes paramount. Prenatal substance exposure is just one of the important factors in this risk assessment, but it is one that parents frequently have questions about before and after the adoption of their child.

Drinking and smoking during pregnancy are usually reported to have a probable effect on fetal development, manifested for the former by retarded psychomotor development termed the fetal alcohol syndrome and for the latter by low birth weight (Simpton & Carson, 1992; Kline et al., 1989).

What is happening today to women in Kazakhstan – an Asian country? Is the stereotype "only men are subject to the smoking and alcohol habits" quite correct? For the last seven years, the level of tobacco consumption in Kazakhstan increased by 8 %, but among the women this parameter increased by 12 %. The same situation is observed in the statistics of the alcohol consumption growth.

Children born out of wedlock and without paternal recognition (illegitimate) suffer high excess mortality has long been known in urban area. This part of analysis will be explained in detail in the next part of this section (perinatal deaths by mother's marital status).

4.2.2 Mother's marital status

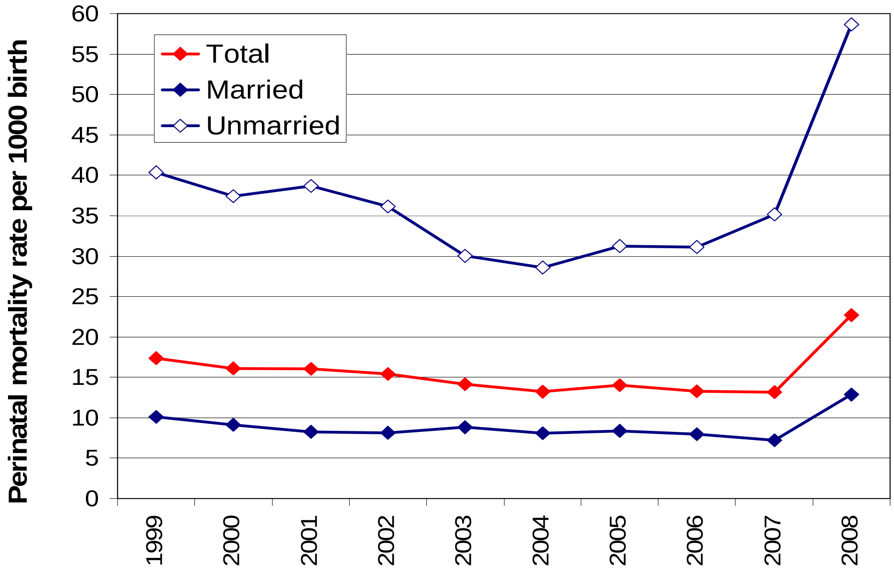
Figure 4.5 presents trend on perinatal mortality rates by mother's marital status. As you can see at the figure the rate is high for unmarried women and this high indicator is observed during whole years. The number of births has increased in both cases of marital status of mother during observed period. Nevertheless, saying in percentage, the proportion of births of married women has increased with comparison to those infants born for unmarried mothers. If, at the beginning of the observed period the share of births was 76% for married women and 24% for unmarried women then the share of births has slightly changed during last year (79% married and 21% for unmarried). The situation in perinatal deaths was not changed as in case of births. However, it is essential to note that the share of perinatal deaths is higher for unmarried mothers (table 4.8).

Table 4.8 - Percentage of births and perinatal deaths by marital status of mother, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Births										
Married	76	75	74	74	75	75	75	77	79	79
Unmarried	24	25	26	26	25	25	25	23	21	21
Perinatal deaths										
Married	44	43	38	39	47	46	45	46	43	45
Unmarried	56	57	62	61	53	54	55	54	57	55

Sources: Unpublished statistical data of Kazakhstan, 2008
Note: Birth is number of live birth plus stillbirth, perinatal death is number stillbirth plus early neonatal death.

Figure 4.5 - Crude perinatal mortality rates (in ‰) by mother's marital status, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

At the figure above (4.5) we can observe that the differences between perinatal death rates by marital status of mother are big enough. High rate for unmarried women is observed during whole period while the rate for married women is lower than overall.

Being unmarried is considered as a risk factor for poor birth outcomes because unmarried women have overall higher rates of low birth weight and infant mortality than married women (MacDorman and Atkinson, 1998; Ventura, 1995). However, assumptions regarding uniform disadvantage for unmarried women may be unfounded. Several studies have found that the effect of marital status on birth outcomes varies by maternal race, age and education (Bennet, 1992; Bennet at al., 1994; Cramer, 1987). Married and unmarried women are both heterogenous groups. Characteristics of the mother's relationship with the father may be more relevant for infant health than formal marital status. However, lack of data on parent's educational attainment, father's age, and ethnicity are not give us a chance to check an effect of the variables when mother is unmarried. Marital status is thought to be related to socioeconomic status, pregnancy intendedness and social support (Chomitz et al., 1995). Researchers have suggested that these and other factors, such as maternal smoking, may explain the inconsistent association between marital status and infant health (Bennet, 1994).

As was previously said when perinatal mortality rates have been compared in urban and rural area one of the reason was women's maternal health. But, in the case of marital status of mother there can be another explanation of the situation on perinatal death. In this case it is essential to note about role of unmarried or single mothers in society and their labor force participation. One of the reasons of high level of perinatal mortality among unmarried mothers can be an outcome of their unemployment.

Unemployment is strongly associated with an increased risk of morbidity and mortality. Unemployed persons use more general health services, have more physical and mental health problems and even have a higher suicide rate than their employed counterparts. Lower levels of psychological well-being have been systematically found in all studies – at all ages and in both sexes (Bartley, 1994; Jin et., 1995).

The unemployment rate among single mothers nationwide is getting worse. That's according to The Institute for Women's Policy Research, which found that there's been substantial growth in unemployment among single moms. Women who support families without the aid of a spouse show an unemployment rate of 12.2 percent compared with 10.2 percent for all men and 8.9 percent for all women, according to Bureau of Labor Statistics data. The data also found that women who maintain families without a spouse present are almost twice as likely as married men to be unemployed, BLS (Bureau of Labor Statistics**)** said.

The economic difficulties after 1991 have reversed some of the accomplishments of the Soviet system on gender issues. The former Soviet Union (FSU) provided protection against gender discrimination. Gender equality of admittance to schools was apparent, female employment was considerable, and substantial benefits were provided for women. Unemployment among women is disproportionately high and those women being still employed earn average wages that are equivalent to only three-quarters of men's. Single mothers and families with many children, especially in rural areas and small towns, are most affected by the decline in incomes.

Just as in many other countries, women's career opportunities are limited by the so-called «glass ceiling». The traditional preconception that a woman cannot be the chief manager allows her to rise to the level of deputy director or vice president of a company, at best. This is especially true in the spheres of public administration, industry, agriculture, science, education, and healthcare (WHO report, MDG in Kazakhstan, 2005).

Moreover, women's professional growth is hampered by the so-called «sticky floor» phenomenon, that is, women have more limited starting opportunities than men when performing their reproductive function, young women leave the wage labor market, losing qualifications, experience, and skills, and upon returning to their workplaces they cannot or don't strive, because of their household duties, to achieve career growth and hold managerial positions. All this makes women less desirable as employees, reducing their incomes and social achievements. Currently, single mothers receive the same allowances as any family with children, depending on family income (WHO report, MDG in Kazakhstan, 2005).

Although Kazakhstan law excludes gender discrimination, the actual situation of women in the labour market has worsened over the last decade. Most often, their labour pays less than that of men's. Women are the first to go during redundancies. They are being excluded from such traditionally female sectors as banking and insurance. Unmarried mothers and single elderly women belong among the poorest categories of the population.

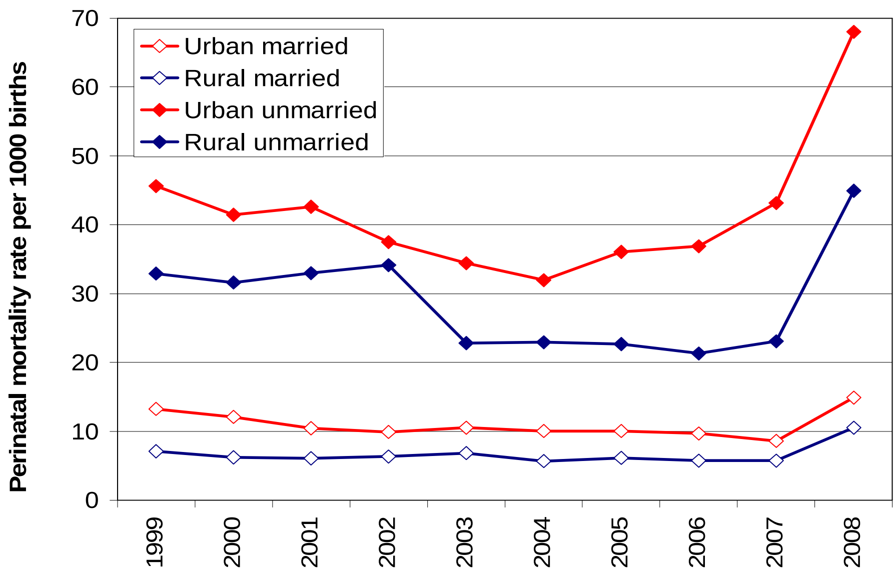
The Concept's chapter «Health of Women Workers» points that unsatisfactory working conditions for women often result from the nonobservance of many labour code provisions relating to female labour. The triple load (work, home, family/children) and malnutrition affect the mental health and overall physical and emotional state of women.

The social status of unmarried mothers in Kazakhstan depends on the community to which the couple belongs. In Russian-speaking communities and among urban Kazakhs, such a practice is quite common and perceived as normal (as a matter of free choice). By contrast, in rural communities of Kazakhs, Uigurs, and other nationalities, and in many southern cities where most Kazakhs live (Chimkent, Djambul, Kyzyl-Orda, etc.), unmarried mothers are perceived negatively.

In addition to whole mentioned facts it is essential to note that unemployment of unmarried women is higher in urban area because in order to survive in short-run living conditions of the cities they have to search job where the salary will be enough for their necessities. At that time it is essential to note that the standard of living conditions are higher in urban area. While women in urban area dependent on their owned level of salary, the situation of women in rural area are different. They are some-how independent. Women in rural area mostly have their own economy or household.

It has been found that perinatal mortality rates by mother's marital status are also varied between mother's places of residence. Figure 4.6 presents perinatal mortality rates by marital status of mother in both areas. The figure 4.6 shows that the rates in both areas are high for unmarried women.

Figure 4.6 - Crude perinatal mortality rates by marital status (in ‰) of mother in urban and rural areas, 1999-2008



Sources: Unpublished statistical data of Kazakhstan. 2008

The number of births has increased in both areas by marital status of mother during observed period. Nevertheless, saying in percentage, the proportion of births of married women in urban area has increased with comparison to those infants born in rural area. If, at the beginning of the observed period the share of births of married women was 37% in urban and 39% in rural area then the proportion of births have changed during last year reaching to 43% in urban and 36% in rural area. The proportion of births of unmarried women in both areas has not changed as this trend is observed for married women. The situation in perinatal deaths was not changed as in the case of births. Nevertheless, it is essential to note that the share of perinatal deaths for both married and unmarried mothers is higher in urban area (table 4.9).

In comparison of crude perinatal mortality rates by place of residence and mother's marital status it is important to keep in mind that we are working with various numbers so-called low and high numbers which will have an effect to the results of the calculation. Different distribution of births and perinatal deaths in both areas by marital status of mother sometimes can not give an adequate picture of the trend. In order to eliminate an effect of low and high numbers it have been calculated standardized perinatal mortality rates for both areas by mother's marital status. Table 5 presents standardized perinatal mortality rates for age of mother by place of residence and marital status of mother.

Table 4.9 - Percentage of births and perinatal deaths by marital status and place of residence of mother, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total births										
Married urban	37	37	37	38	40	41	43	44	41	43
Unmarried urban	14	15	15	16	16	16	16	14	13	13
Married rural	39	38	37	36	35	33	32	33	37	36
Unmarried rural	10	10	10	10	9	9	9	8	8	9
Total	100	100	100	100	100	100	100	100	100	100
Perinatal deaths										
Married urban	28	28	24	24	30	31	31	32	27	28
Unmarried urban	37	37	40	38	38	38	41	40	42	38
Married rural	16	15	14	15	17	14	14	14	16	17
Unmarried rural	19	20	22	23	15	16	14	13	15	17
Total	100	100	100	100	100	100	100	100	100	100

Sources: Unpublished statistical data of Kazakhstan, 2008

When standardizing perinatal mortality rate for mother's age by place of residence it has been found that rate is higher in both areas for unmarried women (Table 5).

Table 5 - Standardized perinatal mortality rates (in ‰) for mother's age by place of residence and marital status of mother, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Urban married	13.2	12.1	10.5	9.9	10.5	10.0	10.1	9.7	8.6	15.0
Urban unmarried	47.0	42.6	43.8	38.7	35.6	32.9	37.0	38.0	44.0	68.3
Rural married	7.0	6.1	5.9	6.3	6.8	5.6	6.1	5.7	5.7	10.5
Rural unmarried	35.6	34.5	36.6	37.6	25.5	25.6	25.3	23.4	25.7	48.0

Sources: Unpublished statistical data of Kazakhstan, 2008

4.4 Adjusted perinatal mortality risks

The study uses the binary logistic regression model. Logistic regression describes the relationship between a categorical response variable and a set of predictor variables. A categorical response variable can be a binary variable, an ordinal variable or a nominal variable.

Logistic regression technique have been used in order to predict a binary dependent variable (perinatal death or survival of 7th day) from a set of independent variables (mother's age, mother's place of residence, mother's marital status, and birth order).

Six models were considered. The first model includes year, mother's place of residence, mother's marital status, and mother's age group as independent factors/variables. The second model contains year, mother's place of residence, parity, and mother's age. The difference between these two models is in regard to the two independent variables. In the first model, independent variables such as mother's age and mother's place of residence were combined with mother's marital status, while in the second model the same variables were combined with child's birth order. The models have dependent (dichotomous) variables: perinatal deaths/survival up to the 7th day (live births-early neonatal deaths). These first two models include the years 1999-2008 (tables 6 & 7), while the next two models (see tables 8 & 9) include the dependent and independent variables in the same order as in the previous two models, the data cover 1999-2007. This exclusion of observed years has been done in order to eliminate the effect of newly-adopted definitions (2008). If the two previous models consider the period 1999-2008, then the next two models consider the period 1999-2007. The last (fifth & sixth) models (tables 10 & 11) include dependent and independent variables, except for year.

The main effect model (Tables 6 & 7) was applied. The estimated odds ratios (adjusted relative risks of dying) often differed from gradients based on crude mortality rates.

Table 6 - Perinatal mortality adjusted risks (Binary Logistic Regression: Main Effects) period 1997-2008 Response variable: perinatal deaths/ survival up to 7th day (live births-early neonatal deaths)

	Odds ratio estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limit**		**Pr>ChiSq**
Year				
2000/1999	**0.903**	0.862	0.945	<.0001
2001/1999	**0.881**	0.841	0.921	<.0001
2002/1999	**0.827**	0.789	0.866	<.0001
2003/1999	**0.758**	0.723	0.794	<.0001
2004/1999	**0.699**	0.668	0.732	<.0001
2005/1999	**0.742**	0.709	0.776	<.0001
2006/1999	**0.723**	0.691	0.756	<.0001
2007/1999	**0.750**	0.717	0.784	<.0001
2008/1999	**1.326**	1.275	1.379	<.0001
1999	**1**			
Place of residence				
Rural/Urban	**0.651**	0.638	0.665	<.0001
Urban	**1**			
Mother's marital status				
Unmarried/Married	**4.492**	4.404	4.582	<.0001

Married	**1**			
Mother's age				
15-19/20-24	**0.748**	0.720	0.778	<.0001
25-29/20-24	**1.073**	1.046	1.101	<.0001
30-34/20-24	**1.282**	1.247	1.319	<.0001
35+/20-24	**1.786**	1.733	1.840	<.0001
20-24	**1**			

Note: 1=reference category, In bold is statistically significant

Table 7 - Perinatal mortality adjusted risks (Binary Logistic Regression: Main Effects) period 1999-2008 Response variable: perinatal deaths/ survival up to 7th day (live births-early neonatal deaths)

	Odds ratio estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limit**		**Pr>ChiSq**
Year				
2000/1999	**0.915**	0.874	0.958	<.0001
2001/1999	**0.905**	0.865	0.948	0.0002
2002/1999	**0.861**	0.822	0.901	<.0001
2003/1999	**0.773**	0.738	0.810	<.0001
2004/1999	**0.717**	0.685	0.751	<.0001
2005/1999	**0.752**	0.719	0.787	<.0001
2006/1999	**0.712**	0.681	0.744	<.0001
2007/1999	**0.717**	0.687	0.750	<.0001
2008/1999	**1.251**	1.203	1.301	<.0001
1999	**1**			
Place of residence				
Rural/Urban	**0.599**	0.586	0.611	<.0001
Urban	**1**			
Child birth order				
2-nd/1-st	**0.721**	0.703	0.739	<.0001
3+/1-st	**0.777**	0.755	0.799	<.0001
1-st	**1**			
Mother's age				
15-19/20-24	0.981	0.943	1.020	0.3263
25-29/20-24	**1.079**	1.051	1.108	<.0001
30-34/20-24	**1.344**	1.303	1.386	<.0001
35+/20-24	**1.907**	1.843	1.973	<.0001
20-24	**1**			

Note: 1=reference category, In bold is statistically significant

As we can observe at the tables 6 & 7 all observed years is statistically significant. Nevertheless, it is essential to note that last year is more statistically significant comparing with other years; OR=1.326 and confidence limit (95%CL) is varied between 1.275 and 1.379 interval in the first model (table 6) and OR=1.251 and confidence limit (95%CL) is varied between 1.203 and 1.301 in the second model (table 7) or simplifying in other word the effect of last year is 25-35% higher than reference category (1999). This higher statistical significance is the result of the newly adopted definitions in the last observed year (2008). Models also show interesting variation in odds ratio by place of residence of mother. In both models we can observe that effect of parameter as urban place of residence of mother is more statistically significant than rural place of residence. If, in the first model analyzing confidence limit (95%CL) we can observe that the effect of the urban parameter is 35-40% higher than rural parameter, then in the second model the effect is also 40-45% higher than rural parameter. These outcomes of the regression model by urban/rural place of residence of mother show similar result as in calculations of crude and standardized perinatal mortality rates by the same variables. During calculation of the crude and standardized perinatal mortality rates in previous sections we have found that the infants at higher risk being dead during perinatal period in urban area. In this section of the analysis of perinatal deaths by logistic regression technique using odds ratio and confidence limit (95%CL) we found that infants in urban area at 35-45% higher risk being dead up to 7th day than in rural area.

Next two independent factors have been considered separately in two models. If, in the first model we consider the effect of marital status of mothers then in the second model we consider the effect of the child's birth order. The reason of the separate consideration of given factors was quality of the data. The data analyzed in the thesis was not simultaneously combined with these two independent factors.

In the 1-st model (table 6) we can see that parameter as unmarried status of mother is more significant: OR=4.492 and confidence limit (95%CL) is varied between 4.404 and 4.582 interval. Reversing the result of the computation of logistic regression technique to the simple percentage we can observe that the effect of parameter as unmarried status of mother is 392% higher than reference category (married). This result shows that infants at four times higher risk to die during perinatal period (up to 7th day) if mother is unmarried. The reasons of so big differences in risks that babies can die up to 7th day when mother is married or unmarried can be explained by different factors. In previous section of this chapter has been tried to explain these factors. One of the main factors that we assumed was socio-economic condition of unmarried mothers (see section 4.2.2).

In the second model in order to evaluate an effect of child birth order to the risk that child can die up to 7th day as a reference category was taken first parity. In table 7 we can observe that effect of the first parity is more statistical significant than second and over than third parities. OR=0.721, 95%CL=0.703-0.739 for second parity and OR=0.777, 95%CL=0.755-0.799 for over than third parities. These results show that child in first parity at between 30 and 40% higher risk to die up to 7th day. Results of the crude and standardized perinatal mortality rate calculations in the previous section also showed that the rate is higher for first born babies. The risk of perinatal deaths steadily increases with maternal age: the lowest for the youngest women and the highest for the oldest mothers, 30-34, 35+ (Tables 6, 7). In both models we can observe that effect of ages 30-34 and over than 35 is statistical significant than reference category (20-24 ages). In the first model OR=1.282 for 30-34 ages and 1.786 for over than 35 ages. In the second model OR=1.344 for 30-34 ages and 1.977 for over than 35 ages. These odds ratio results show that infant or child at 20-30% higher risk at 30-34 and at 70-100% higher risk at ages over than 35.

All factors apparently play an important role. It has been determined that child at high risk to die up 7th day when mother's place of residence is urban, mother's marital status is unmarried, and mother's ages are 30-34 and over than 35, and when the child birth order is first parity.

Next two models present same dependent and independent variables for the period 1999-2007.

Table 8 - Perinatal mortality adjusted risks (Binary Logistic Regression: Main Effects) period 1999-2007 Response variable: perinatal deaths/ survival up to 7th day (live births-early neonatal deaths)

	Odds ratio estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limit**		**Pr>ChiSq**
Year				
2000/1999	**0.902**	0.862	0.945	<.0001
2001/1999	**0.880**	0.840	0.922	<.0001
2002/1999	**0.826**	0.789	0.865	<.0001
2003/1999	**0.756**	0.722	0.792	<.0001
2004/1999	**0.698**	0.667	0.731	<.0001
2005/1999	**0.740**	0.707	0.774	<.0001
2006/1999	**0.720**	0.689	0.753	<.0001
2007/1999	**0.747**	0.714	0.781	<.0001
1999	**1**			
Place of residence				
Rural/Urban	**0.645**	0.631	0.661	<.0001
Urban	**1**			
Mother's marital status				
Unmarried/Married	**4.372**	4.276	4.469	<.0001
Married	**1**			
Mother's age				
15-19/20-24	**0.706**	0.676	0.738	<.0001
25-29/20-24	**1.079**	1.048	1.110	<.0001
30-34/20-24	**1.294**	1.254	1.335	<.0001
35+/20-24	**1.794**	1.735	1.855	<.0001
20-24	**1**			

Note: 1=reference category, * statistically significant

Table 9 - Perinatal mortality adjusted risks (Binary Logistic Regression: Main Effects) period 1999-2007 Response variable: perinatal deaths/ survival up to 7th day (live births-early neonatal deaths)

	Odds ratio estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limit**		**Pr>ChiSq**
Year				
2000/1999	**0.914**	0.873	0.957	<.0001
2001/1999	**0.904**	0.863	0.947	0.0001
2002/1999	**0.859**	0.820	0.899	<.0001
2003/1999	**0.771**	0.736	0.807	<.0001
2004/1999	**0.715**	0.683	0.748	<.0001
2005/1999	**0.749**	0.716	0.784	<.0001
2006/1999	**0.709**	0.678	0.741	<.0001
2007/1999	**0.715**	0.684	0.747	<.0001
1999	**1**			
Place of residence				
Rural/Urban	**0.592**	0.578	0.606	<.0001
Urban	**1**			
Child birth order				
2-nd/1-st	**0.703**	0.683	0.723	<.0001
3+/1-st	**0.761**	0.737	0.785	<.0001
1-st	**1**			
Mother's age				
15-19/20-24	**0.913**	0.874	0.954	<.0001
25-29/20-24	**1.093**	1.062	1.126	<.0001
30-34/20-24	**1.364**	1.317	1.412	<.0001
35+/20-24	**1.931**	1.859	2.006	<.0001
20-24	**1**			

Note: 1=reference category, In bold is statistically significant

As we can observe at those two tables (8 & 9) the result is almost same as in the two the previous tables (6 & 7). In both models the data combined with marital status of mother (3-rd model) and with child's birth order (4-th model) we can observe that the effect of the parameter as urban residence of mother is more statistically significant. In the third model (table 8) we observe that after the significance of the urban place of residence of mother the most statistically significant variable is unmarried status of mother. As in the case of two previous models the risk of perinatal deaths steadily increases with maternal age: the lowest for the youngest women and the highest for the oldest mothers, 30-34, 35+ (Tables 8, 9). A higher risk of perinatal deaths is observed for the first births. Again, considering these two models we can conclude that child at high risk when mother's place of residence is urban, mother's marital status is unmarried, mother's ages are 30-34 and over than 35, and when the child birth order is first parity.

In the tables 8 & 9 we assume that the role of definitions adopted in 2008 and new registration practices do not have an effect to the models. If at the tables 6 & 7 (Models 1 & 2) we observe different effects of factors on perinatal deaths (up to 7^{th} day) than in the table 8 & 9

(Models 3 & 4) we could see same result. Next two models (5 & 6) present the same variables (factors) but with exception of years (tables 10 & 11).

Table 10 - Perinatal mortality adjusted risks (Binary Logistic Regression: Main Effects) period 1999-2008 Response variable: perinatal deaths/ survival up to 7th day (live births-early neonatal deaths)

	Odds ratio estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limit**		**Pr>ChiSq**
Place of residence				
Rural/Urban	**0.647**	0.632	0.662	<.0001
Urban	**1**			
Mother's marital status				
Unmarried/Married	**4.361**	4.266	4.458	<.0001
Married	**1**			
Mother's age				
15-19/20-24	**0.707**	0.677	0.739	<.0001
25-29/20-24	**1.078**	1.047	1.109	<.0001
30-34/20-24	**1.294**	1.254	1.335	<.0001
35+/20-24	**1.795**	1.736	1.856	<.0001
20-24	**1**			

Note: 1=reference category, In bold is statistically significant

Table 11 - Perinatal mortality adjusted risks (Binary Logistic Regression: Main Effects) period 1999-2008 Response variable: perinatal deaths/ survival up to 7th day (live births-early neonatal deaths)

	Odds ratio estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limit**		**Pr>ChiSq**
Place of residence				
Rural/Urban	**0.598**	0.632	0.662	<.0001
Urban	**1**			
Child birth order				
2-nd/1-st	**0.705**	0.683	0.723	<.0001
3+/1-st	**0.764**	0.737	0.785	<.0001
1-st	**1**			
Mother's age				
15-19/20-24	**0.925**	0.677	0.739	<.0001
25-29/20-24	**1.084**	1.047	1.109	<.0001
30-34/20-24	**1.345**	1.254	1.335	<.0001
35+/20-24	**1.899**	1.736	1.856	<.0001
20-24	**1**			

Note: 1=reference category, In bold is statistically significant

In both models the data combined with marital status of mother (5-rd model) and with child's birth order (6-th model) again we observe that the effect of the urban residence of mother is more significant. In the fifth model we can again see that the effect of the unmarried status of mother is more significant. The risk of infants to die during perinatal period (up to 7th day) is 361%

higher than when mother is unmarried. As in the case of two previous models again the risk of perinatal deaths increases with maternal age in both last two models: the lowest for the youngest women and the highest for the oldest mothers, 30-34, 35+ (Tables 8, 9). A higher risk of perinatal deaths is observed for the first births with 30-40% higher significance than 2-nd and 3+ babies. Again, at the end we can conclude that child at higher risk when mother's place of residence is urban, mother's marital status is unmarried, and mother's age is 30-34 and over than 35 year and when the child birth order is first parity.

4.5 Summary

Using logistic regression methods we observed the effects of different parameters of demographic and social factors on perinatal deaths (up to the 7th day) in Kazakhstan. We have found the most sensitive sides of the reasons for perinatal death.

In order to verify our hypothesis and answer the questions, we calculated crude and standardized perinatal mortality rates, and also computed the odds ratio (OR), confidence limits (95% CL), and statistical significance using logistic regression techniques. For presenting the results of the logistic regression we constructed six models. The results of the crude and standardized perinatal mortality rate, calculated by various characteristics of the childbearing population, show different variations in perinatal deaths in Kazakhstan. After calculating the odds ratio, confidence limit, and statistical significance, we found that the separate parameters of various analyzed demographic and social factors have serious effects on the risk of dying during the perinatal period (up to the 7th day). At the beginning of the observation several questions were asked:

1) Do the investigated factors affect to pregnancy outcome?
2) Do significant differences exist in perinatal deaths by place of residence of mother?
3) Do parameters of marital status of mother affect at same level?
4) Are demographic factors more important than social factors?

In answer to the first question, we can say definitively that investigated factors affect the pregnancy outcome. This effect is at a different level when each separate factor is considered according to individual parameters. Calculating crude and standardized perinatal mortality rates, we could see how perinatal mortality rates varied by different social and demographic factors. However, we could not see the effect of each individual parameter, such as urban/rural, married/unmarried, etc., taken together in a multidimensional perspective. Using logistic regression techniques, we found that a child is at a higher risk of dying during the perinatal period when the mother's place of residence is urban, her status is unmarried, her age is 30-34 or over 35 years, and when the child's birth order is first parity. When answering the second and third questions, we found significant differences between the analyzed individual parameters of place of residence and marital status of mother. In all the models we could observe that the effect of a mother's urban place of residence, as a parameter, is more statistically significant than a rural place of residence. If, for example, in the first model analyzing odds ratios and confidence limits (95% CL), we found that the effect of the urban parameter is 35-40% higher than the rural parameter, then in the second model the effect was 40-45% higher than the rural parameter. As in the case of the urban/rural factor, in all models we observed that the parameter of unmarried status of mother was more significant: OR=4.492 and the confidence limit (95% CL) varied between 4.404 and 4.582. Reversing the result of the computation of logistic regression techniques to a simple percentage, we can observe that the effect of the parameter of unmarried status of mother is 392% higher than the reference category (married). This result shows that infants are four times more likely to die during the perinatal period (up to the 7^{th} day) if the mother is unmarried.

In answering the last question, we cannot exactly say that one of the factors is more important than the other. Each of the analyzed demographic and social factors are important for understanding the situation of perinatal deaths in Kazakhstan, and a detailed analysis and evaluation of the effects of each of them can help to prevent unfavorable incidents of perinatal losses. Nevertheless, it is essential to note that through a multidimensional analysis of perinatal deaths according to place of residence and marital status of mother, using logistic regression techniques, we found that the effects of such parameters as urban residence and unmarried status of mother are relatively more significant than rural residence and married status of mother. The next chapter of the thesis presents national policy related to perinatal deaths in Kazakhstan.

5. National policy

The first phase of the implementation of the plan of action to fulfill the basic short-term tasks of the State Program «Health of the Nation», adopted in 1998, is now complete. The complex epidemiological situation has been overcome, and the set of guaranteed healthcare services has been expanded, thus the constitutional right of the citizens to health care is now provided.

The Concept for improving the financing of the healthcare system in Kazakhstan has been adopted. Its implementation will allow for the creation of an optimal organizational structure and a model of financing the healthcare system that guarantees availability and quality of medical services.

In addition to the «Health of the Nation» State Program, there is the «Maternal and Child Health Protection in Kazakhstan for 2001-2005» program. Its main goals are to create the necessary conditions for the protection and improvement of the lives and health of mothers and children as well as to prevent and decrease their morbidity.

The Law on Social, Medical, and Correctional Support to Children with Limited Abilities was adopted in 2002 to create an effective system of assistance to children with developmental deficiencies and to prevent child disability (disablement).

The Strategy of Perinatal Care Improvement was adopted. This includes the WHO programs on Safe Maternity/Assistance in Increasing the Effectiveness of Perinatal Services, which envisage the mandatory introduction of the WHO definitions of «live birth» and «stillbirth».

Based on the Strategy of Perinatal Care Improvement in the Republic of Kazakhstan, **the Plan of Perinatal Care Improvement** in the Republic of Kazakhstan was development and approved by the decree of the Ministry of Healthcare #871 of 26 November 2003.

The Plan's main strategies are aimed at the following:

1. Improvement of the health of women of the reproductive age;
2. Improvement of the perinatal care provided to mothers and children;
3. Enhancement of the organization and management of the perinatal services through regionalization of perinatal care;

4. Enhancement of the professional skills of health personnel for provision of perinatal services;
5. Monitoring and assessment of measures on improving perinatal services.

1. Improvement of the health of women of reproductive age is the most complex and long-term task, as its achievement is defined by the socio-economic conditions of the families and the country overall, and by the quality and accessibility of health services.

This task is examined in more detail in the next chapter; however, it needs to be noted that the correction of micronutrient deficiencies, as described in Part 2 of Chapter 1, is one of the most effective ways to improve public health, including the health of both women of reproductive age and their children.

2. Improvement of the quality of perinatal care requires the introduction in obstetric practices of safe maternity and neonatal care technologies recommended by WHO and developed on the basis of controlled randomized research.

Since most cases of death in the early neonatal period occurred among newborns with regular birth weights, such losses can be prevented through the introduction of low-cost practices of perinatal care of the evidence-based medical research that are recommended by WHO in its programs of Safe Maternity/Assistance in Increasing the Effectiveness of Perinatal Services. This will first of all ensure the survival of newborns with normal birth weights. With ensured survival of the newborns with normal birth weight, the losses among the newborns with very low and extremely low birth weight in the perinatal period will have little influence on the infant mortality rate and, therefore, on the under-five mortality rate.

These technologies are currently being introduced in pilot obstetric facilities. The preliminary results of their introduction in the Almaty Perinatal Center show a decrease in the loss of newborns to birth trauma, asphyxia, and other respiratory disorders. Prenatal preparation of pregnant women lead to a reduction of pregnancy complications (gestosis decreased 1.3 times, and miscarriage threats – 1.4 times) as well as delivery complications (pre-term births decreased twofold and surgical deliveries decreased 1.8 times).

3. Regionalization of perinatal care and the improvement of perinatal services management will promote a more rational distribution of financing allocated for obstetric services. The bulk of these resources allocated to the third-tier facilities, such as perinatal centers where pregnant women of high-risk groups and pre-term deliveries with 22-32 weeks of gestation are taken. Newborns with severe perinatal pathologies and low (1,000-1,500 g) and extremely low (500-999 g) birth weights, who need expensive medication and equipment, are also taken to the perinatal centers.

Women with physiological courses of pregnancy at minimal risk, and those with pre-term deliveries at more than 32 weeks of gestation are taken to the first-and second-tier hospitals. Babies born in these facilities are usually healthy and have normal birth weights, so providing them with timely and quality perinatal care does not require high-cost technologies.

4. Improvement of the perinatal care skills of the health personnel working in obstetric facilities will undoubtedly help improve the quality of and access to perinatal services, and reduce maternal, perinatal, and neonatal morbidity and mortality.

5. Monitoring and evaluation of measures to improve perinatal care will allow for the collection, systematization, assessment and analysis of data so as to select most appropriate kinds of interventions. The latter is accomplished through the introduction of the BABIES matrix in the registration and reporting documentation of the healthcare system. The BABIES matrix provides for mandatory registration of all perinatal births and losses because the indicators calculation takes into account the birth weight of the newborns and infants who died.

Effective monitoring of obstetric and child care services and their main indicators is not possible without the registration of all perinatal losses (starting from the 22nd week of gestation, with a birth weight of 500 g or more). The absence of such monitoring restricts timely identification of the existing problems and interventions for their solution. This stipulates the necessity and advisability of adopting the WHO definition of «live birth» and accounting for perinatal losses. Only under the condition that these steps are taken does Kazakhstan have a chance to achieve MDG 4 – to reduce, by 2015, the under-five mortality rate by two-thirds of the baseline level (1990).

It is also necessary to keep other problems in mind (socio-economic, environmental, etc), because the solution to these problems influences obstetric and child care indicators.

Thus, there is an obvious need for a scaled-up implementation of the above-mentioned tasks of the Plan on Improving the Perinatal Care in the Republic of Kazakhstan through the introduction of perinatal care technologies in obstetric practice, which will contribute to the reduction of infant and child mortality.

The State Program on Healthcare Reform and Development in Kazakhstan for 2005-2010, approved in late 2004, and the 2005-2007 Plan of Action for its implementation outline the need for innovations in the primary healthcare system and are an important step in achieving a higher health index.

5.1 Sufficient access to and quality of primary health care

Sufficient access to and quality of primary health care (PHC) are also key factors for reducing infant and child mortality risks. The State Program on Healthcare Reform envisages the creation of a new primary health care model that will be based on the principles of general medicinal practice and will consist mainly of PHC centers on a social procurement contract with a healthcare management agency. This model will work on the basis of trust (free choice of doctor) with the use of economic management and motivation methods, such as introduction of a bi-component per capita standard with partial stockholding, management system development and enhancement of healthcare quality through the use of an evidence-based medicine concept. A partial stockholding system creates incentives for reducing the amount of hospital and specialized services. Universal implementation of the per capita financing concept, together with a stockholding component at the second stage of program implementation, will contribute to the financial, technological, and professional sustainability of the system. By 2010, the resources allocated for PHC will amount to less than 40% of the total financing of guaranteed healthcare services.

5.2 Enhanced coordination for improvement of the health of the population

Achieving results in the healthcare sector depends on effective government intervention that can be ensured through better coordination, consultations, and links between the ministries and departments. Any healthcare reform should be regarded as a program the implementation of which involves several ministries and departments, and not the Ministry of Healthcare alone.

In accordance with the State Program on Healthcare Reform for 2005-2010, regional programs were developed and approved by Maslikhats, and Coordination Councils were created in all oblasts, which is a precondition for the actual financing of the action plans, monitoring, and control over implementation of this important policy document. Successful program implementation requires the focused and concerted efforts of the healthcare system, along with the support of other branches and technical assistance of international organizations.

Strengthened role of MoH (Ministry of Health) in defining national healthcare policy. This includes the passing of the necessary legislative degrees, particularly regarding the change to WHO live birth and perinatal losses criteria. The absence of such criteria at present reduces the opportunity to understand rationally and in a timely manner the problems related to causes of infant and child mortality and, therefore, make it harder to manage the situation and take appropriate measures to improve it.

5.3 Development of a sustainable healthcare financing structure

Kazakhstan's economic growth stimulated the development of social programs. In the past three years (2005-2007), public health financing increased twofold. A further increase in financing, up to 4% by 2008, is planned to ensure the sustainable development of the healthcare system. Taking into account the GDP growth, the amount of budget spending on public health in absolute numbers will increase more than three times by 2010.

A system of financing that is based on the principle of efficiency and equitable distribution of funds and resources lies at the heart of any healthcare reform program. It is necessary to review the per capita financing in primary, maternal, and child healthcare, as the currently allocated resources are significantly below the level needed for provision of a basic PHC service package.

Having inadequate resources to satisfy public needs in healthcare services, Kazakhstan, like many other countries, has introduced a regulation mechanism and defined a guaranteed amount of healthcare. Any basic services package financed by the government should prioritize services, diagnostic and medical methods, target groups receiving aid, financing mechanisms, and service providers. In addition to this, expanded service packages can be introduced. They may be partly financed by the clients themselves, such as the voluntary medical insurance already available in Kazakhstan.

Since the guaranteed amount of free healthcare does not correspondent to the state’s financial capacity and in many aspects is not well defined, the Government of Kazakhstan passed a decree at the end of 2004 on the Guaranteed Amount of Free Healthcare in 2005, reducing somewhat the state guarantees and providing better definitions of socially protected groups. The formulation of the guaranteed healthcare services package is based on the financial capacity of the state, social justice in access to healthcare, transparency, and the division of responsibility for health protection between the state, employer, and the citizens themselves.

Additional resources were already allocated in the republican budget for the purchase of medications and medical goods on the regional level within the approved guaranteed amount. This might be one of the first steps towards creating a better service package.

With the growth of the state’s financial capacity, the guaranteed amount of free healthcare services will grow, too. Healthcare facilities will use additional resources on increasing wages, compensation of expenditure, strengthening of the material base, and training and re-training of personnel.

The implementation of the concept of joint responsibility of the state and people for health protection will be carried out by conducting preventive measures and formulating healthy lifestyles. The main bulk of work in this sphere will be carried out by PHC facilities.

Some innovative approaches have already been introduced in the financing system, such as per capita financing of PHC, tariffs on specialized aid, and payment by clinical expenditure groups in the hospitals. Within the Healthcare Reform Program, it is envisioned that the system of centralized management of financial resources will be implemented on the oblast level (with the oblast public health management unit as the single payer). Such a system will create conditions for leveling the per capita standards of PHC and hospital fees within the regions and strengthen healthcare services quality control. The filling-up of the per capita standard will take place annually, reaching its optimal level in 2008. Similarly, in 2008, the fees for analogous healthcare services will be leveled across regions with objective factors taken into account. Unified methods of medical fees formulation will be developed, ensuring the financial sustainability of healthcare facilities. The decrease of hospitalization levels will be accompanied by the growth of fees for such services, with the fees reaching their optimal level. During 2005, measures on improving the system of health personnel remuneration and introducing the concept of differential pay by end result, taking into account professional qualifications and the quality and amount of service provided will be taken. Starting in 2006, the wages of medical workers will gradually be increased. Transparency of the use of funds allocated for guaranteed free healthcare and personalization of healthcare services and goods will be ensured and patients' control system will development and the population's income growth progress, the introduction of mandatory medical insurance will be considered be introduced. By 2008, as the countries socio-economic and the population's income growth progress, the introduction of mandatory medical insurance will be considered.

5.4 Improvement of the quality of healthcare services

The creation of the new healthcare quality management system also envisages standardization and implementation of new diagnostic and treatment protocols of the evidence-based medicine that help improve the quality of service at all stages of treatment.

Regulation of the quality of healthcare services presupposes the following:

- Licensing, accreditation, external and internal evaluation of healthcare services providers;
- Implementation of the concept of differential remuneration of health personnel, taking into account the quality of services;
- Creation of a unified information system to monitor the quality and effectiveness of provided services.

In 2005, the State Committee on Control of the Quality of Healthcare Services was created to carry out quality management. Independent experts will be invited to run control checks. It is expected that an independent expertise institute will be created, and that professional organizations will participate in this effort.

5.5 Improvement of parenting skills

Scientific research shows that parents play an important part in a child's development. The development of the human brain is most intensive in the first years of life. At this stage, good health, proper nutrition, and a conducive to development environment define the development of physical and cognitive abilities and lay foundations for future well-being. Children who got a good start in life are better at school; they become steady and productive adults and, if provided with favorable opportunities, fully realize their potential.

Investments in early childhood development are the most effective public investments. Improvement of parenting skills is a low-cost but very powerful strategy for complex childhood health and development. Since 2004, UNICEF has been implementing a Better Parenting Initiative in the pilot regions (East-Kazakhstan and Kyzylorda oblasts) through the national system of home-nursing for children at an early age. The program's goal is to enhance parents' knowledge and skills on the issues of appropriate nutrition, development and care needed for an ill child, and nutrition for pregnant women.

The main priorities of the healthcare system in the area of maternal and child health will be the following:

- 100% provision of free medical and preventive care to women during pregnancy, during delivery, and after delivery, to children under 5 years of age, and to those on dispensary books;
- development of a program on enhancing the material base;
- installation of equipment that meets the standard requirements in the MCH facilities;
- provision of necessary medication to pregnant women, children under 5 years of age, and patients registered on dispensary books;
- creation of a republican children's rehabilitation center.

At the same time, the state will work on the provision of reliable, objective, and accessible information on health protection, healthy lifestyles, rational nutrition principles, and disease prevention skills. The state will also implement programs counteracting drug addiction, alcoholism, and smoking.

One of the main priorities outlined in the Kazakhstan-2030 Strategy and State Program on Health Reform is improvement of the demographic and health situation in the country, which is first of all related to the protection of mothers' and children's health. The main goal of the MCH service is to create an effective system that ensures the preservation and improvement of mothers' and children's health and the reduction of maternal, infant, and child mortality.

6. Conclusion

This concluding chapter highlights and summarises the results of the analysis. Conclusions of the empirical findings are extended for the generalisation about the meaning of perinatal death in the Republic of Kazakhstan.

6.1 Empirical findings

First, we investigated the theoretical framework related to perinatal mortality, introducing definitions, historical trends in infant and fetal mortality in European countries, and the risk factors of perinatal deaths at different levels, trying to identify a theoretical basis for the purposes of the perinatal mortality study in Kazakhstan. On the basis of the theoretical framework, we analyzed the trends and variations in perinatal mortality in Kazakhstan, explaining the process in relation to various social and demographic factors. Analyzing trends in perinatal mortality during the period 1999-2008 we found a sharp increase in crude perinatal mortality rates during the last observed year (2008). The sharp increase in rates was due to an increase in the number of live births, stillbirths, and early neonatal deaths. The reason for the increase in the number of live births and stillbirths was the result of the newly-adopted definitions of “viability”, “live birth”, and “stillbirth” recommended by WHO, which were adopted in 2008 (January 1). Before adopting the new definitions of live birth and stillbirth, Kazakhstan used the old so-called “Soviet” definitions of live birth and stillbirth. Thus, the definitions of “live birth” and “stillbirth” were found to be one crucial determinant of perinatal mortality rates.

In the next part of our empirical analysis we observed different risk factors which can affect perinatal death. According to the availability of data, we identified two groups of factors: 1) demographic, including such variables as age of mother, child birth order, and child’s gender; and 2) social, including place of residence and marital status of mother. Crude perinatal mortality rates were computed for all the mentioned variables, and standardized perinatal mortality rates were computed for some of them. During an analysis of the crude perinatal mortality rate by demographic factors such as child's gender, we found that perinatal mortality rates are generally higher for boys than for girls. There were significant differences in mortality risks associated with the mother's age and birth order. A higher rate was observed for the age group over 35 years old, i.e., we observed a J-shaped relation during the whole analyzed period. Physiological factors were proposed as one of the reasons for the high perinatal mortality rate among mothers in the age group over 35 years old. Other factors, such as an unfavorable socio-economic position, the absence of a partner, and a lack of social support also play an important role in this age group.

The crude perinatal mortality rate was relatively higher for infants of primaparas, and lower for children born second, third, or later in the order. The calculation for child birth order computed by the standardization method showed the same result as the crude rate calculation, i.e., the risk is higher for first born babies. Analyzing perinatal deaths by social factors, we found that perinatal mortality rates were lower in rural than in urban areas during the whole observed period. After using the standardization method for both areas, we found that the perinatal mortality rate was again lower in rural areas, just as in the case of the crude perinatal mortality rate calculation. We assumed that the high level of accessibility and quality of medical care in urban areas was the main reason for the low level of perinatal deaths. However, analyzing the situation of perinatal deaths according to urban/rural place of residence of mother, we found that the higher level of accessibility and quality of medical services in urban areas compared to rural ones cannot be the main reason for the low level of perinatal deaths in urban areas. The reason for the higher level of perinatal deaths in urban areas was explained by other factors. These factors, which include induced abortion, marital status (unmarried), and behavioral factors as alcohol and smoking were proposed as one of the reasons for the high level of perinatal mortality in urban areas. We found that the above-mentioned factors were more frequent in urban areas. Historically, populations in rural areas of Kazakhstan are more traditional than those in urban areas. Use of contraceptive methods, abortions, alcohol and smoking are more frequent among urban populations than rural.

Analyzing perinatal death by married and unmarried status of mother, we found that the risk of infants dying during the perinatal period is higher for unmarried mothers. On the basis of the theoretical framework we assumed that the high level of perinatal deaths among unmarried mothers could be a result of their unemployment. After analyzing the unemployment level in Kazakhstan we found that unemployment is higher among women than among men. These differences increase whether the women are married or unmarried. The economic difficulties after 1991 reversed some of the accomplishments of the Soviet system on gender issues. The former Soviet Union provided protection against gender discrimination. Gender equality of admittance to schools was apparent, female employment was considerable, and substantial benefits were provided for women. Unemployment among women is disproportionately high, and those women who are still employed earn average wages that are equivalent to only three-quarters of men's wages. We found that single mothers and families with many children, especially in rural areas and small towns, are most affected by the decline in incomes. The social status of unmarried mothers in Kazakhstan depends on the community to which the couple belongs. In Russian-speaking communities and among urban Kazakhs, such a practice is quite common and perceived as normal (as a matter of free choice). By contrast, in rural communities of Kazakhs, Uigurs, and other nationalities, and in many southern cities where most Kazakhs live (Chimkent, Djambul, Kyzyl-Orda, etc.), unmarried mothers are perceived negatively.

In addition to all the facts mentioned, we also found that unemployment of unmarried women is higher in urban areas because in order to survive in the short-run living conditions of cities, they have to search for a job with a high enough salary to provide for their necessities. While women in urban areas are dependent on the level of their own salary, the situation of women in rural areas is different. They are somehow independent. Women in rural areas mostly have their own economy or household.

In the next part of our empirical analysis we observed the association between risk factors (age of mother, child birth order, place of residence and marital status of mother) and perinatal deaths expressed as adjusted odds ratios (OR), a 95% confidence interval (CI), and the level of significance. For this purpose, six models were constructed using logistic regression techniques. All operations related to logistic regression modeling were computed with the help of SAS software. Logistic regression was used in order to predict a binary dependent variable (perinatal death or survival of the 7^{th} day) from a set of independent variables (mother's age, mother's place of residence, mother's marital status, and birth order).

Using logistic regression techniques, we found that a child is at a higher risk of dying during the perinatal period when the mother's place of residence is urban, her marital status is unmarried, and her age is 30-34 or over 35 years, and when the child's birth order is first parity. Analyzing perinatal deaths by logistic regression techniques, we found significant differences between analyzed separate parameters, such as place of residence and marital status of mother. In all models, we could observe that the effect of urban place of residence of mother as a parameter was more statistically significant than rural place of residence. If, for example, in the first model analyzing odds ratios and confidence limits (95% CL) we found that the effect of the urban parameter was 35-40% higher than the rural parameter, then, in the second model, the effect was 40-45% higher than the rural parameter. As in the case of the urban/rural factor, we saw that the parameter of unmarried status of mother was more significant: OR=4.492 and confidence limit (95% CL) varied between 4.404 and 4.582. Reversing the result of the computation of logistic regression to a simple percentage, we observed that the effect of the parameter of unmarried status of mother was 392% higher than the reference category (married). This result shows that infants are four times more likely to die during the perinatal period (up to the 7^{th} day) if the mother is unmarried.

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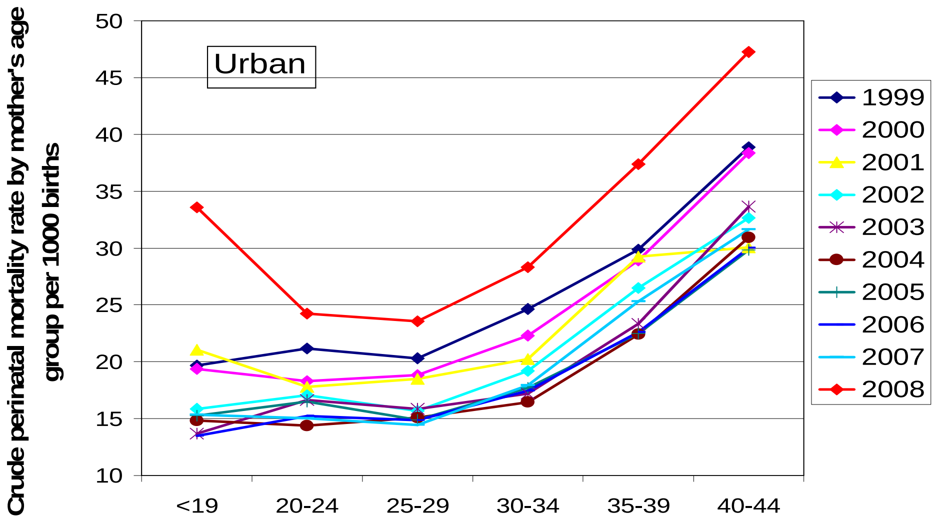
Annex

This section presents list of figures in crude perinatal mortality rates.

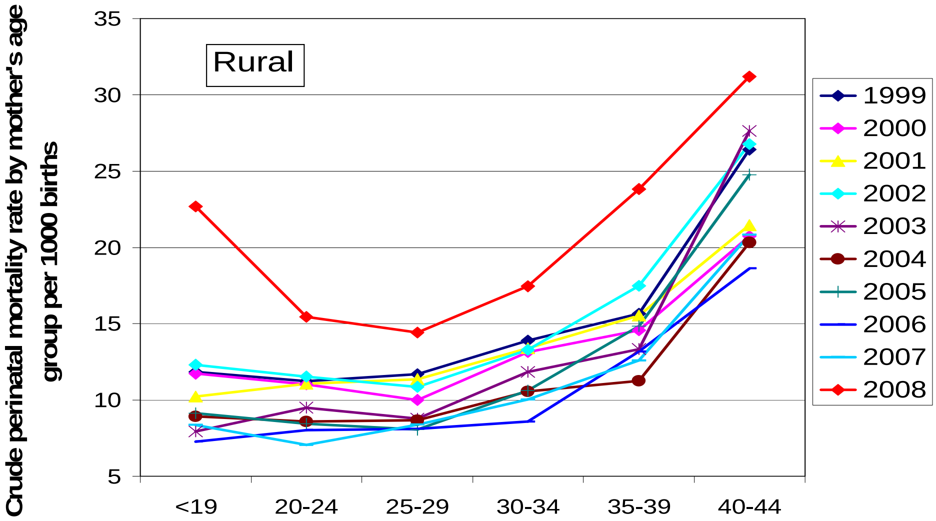
Annex – 1 Crude perinatal mortality rates by age group, place of residence and marital status of mother

Figure 1a - Crude perinatal mortality rates (in ‰) by age group of mother, urban area, 1999-2008



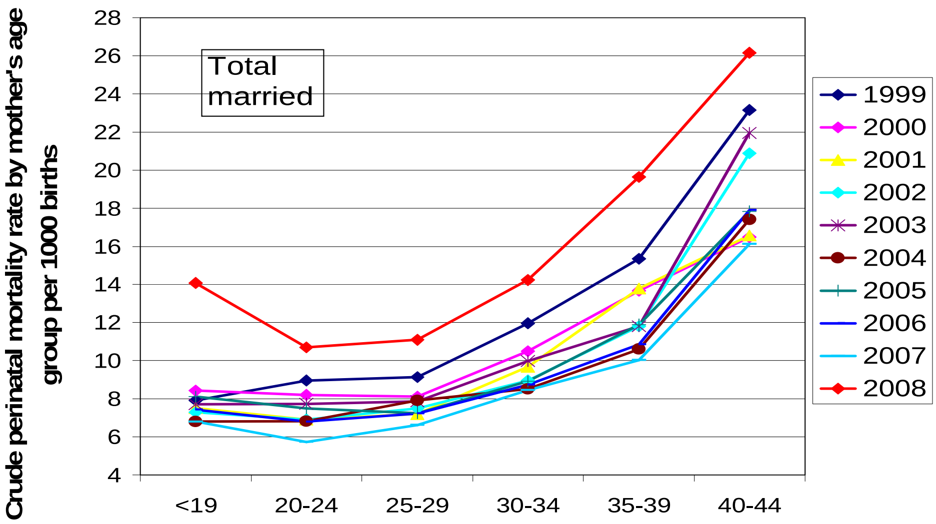
Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 1b - Crude perinatal mortality rates (in ‰) by age group of mother, rural area, 1999-2008



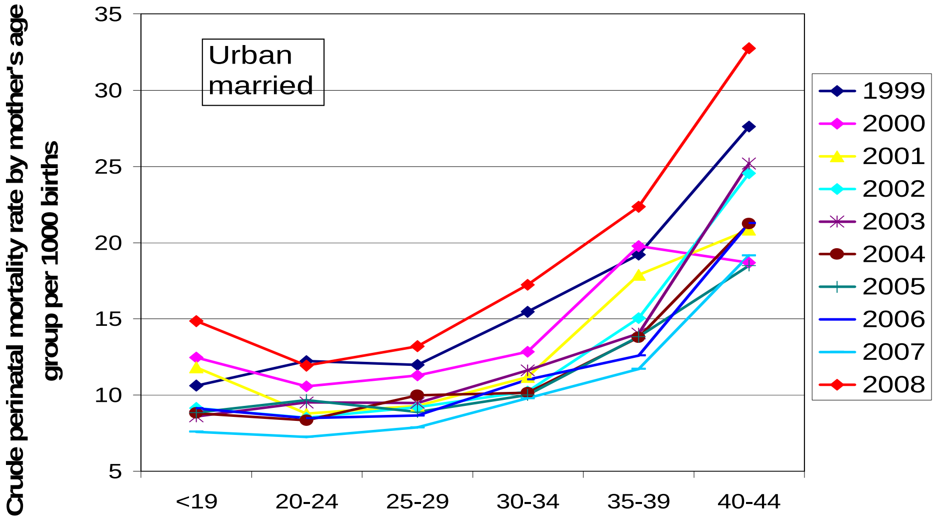
Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 1c - Crude perinatal mortality rates (in ‰) by age group of mother, married, 1999-2008



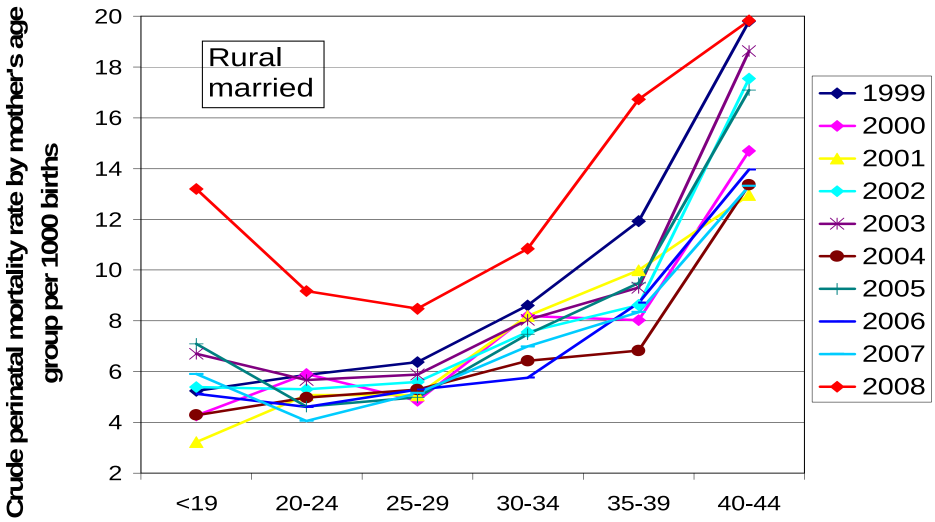
Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 1d - Crude perinatal mortality rates (in ‰) by age group of mother, urban married, 1999-2008



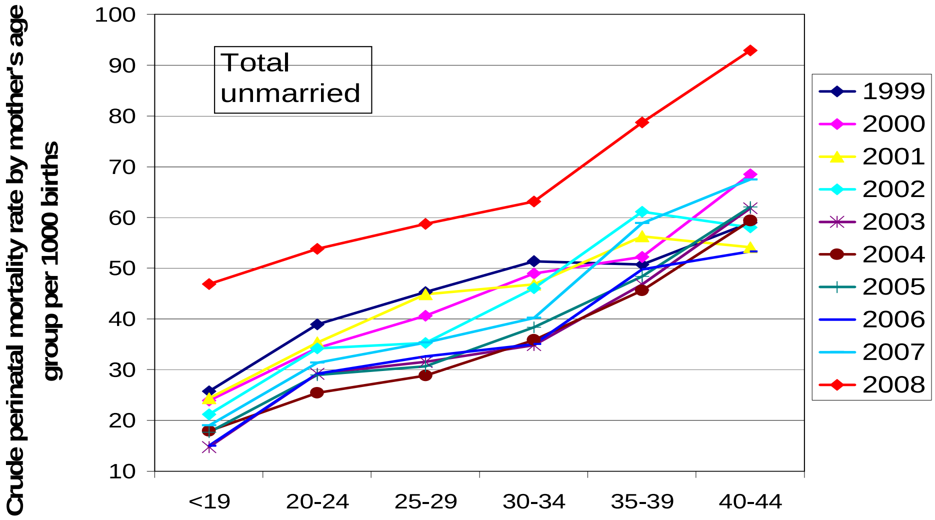
Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 1e - Crude perinatal mortality rates (in ‰) by age group of mother, rural married, 1999-2008



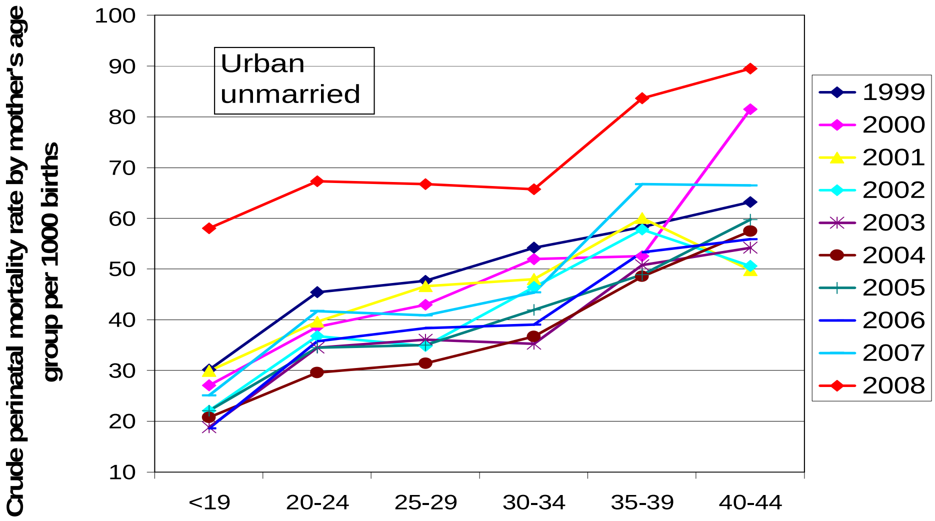
Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 1e - Crude perinatal mortality rates (in ‰) by age group of mother, unmarried, 1999-2008



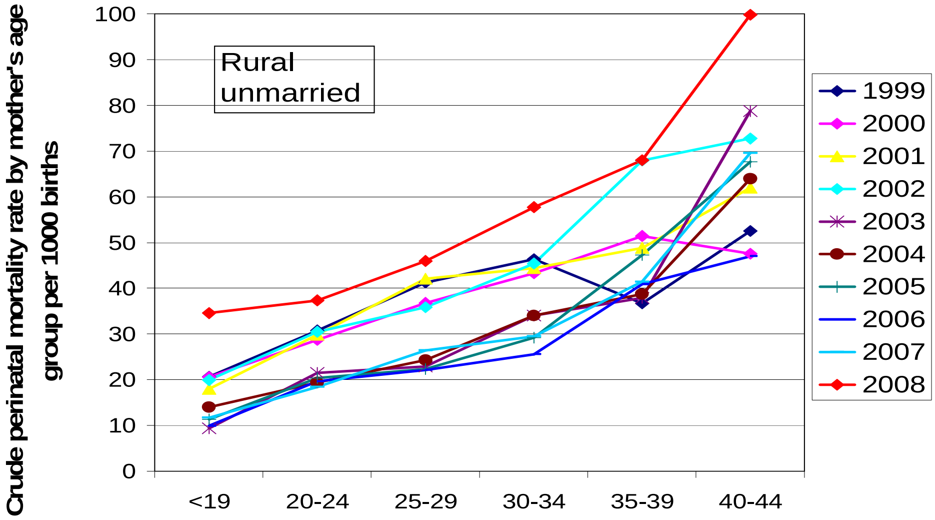
Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 1f - Crude perinatal mortality rates (in ‰) by age group of mother, urban unmarried, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

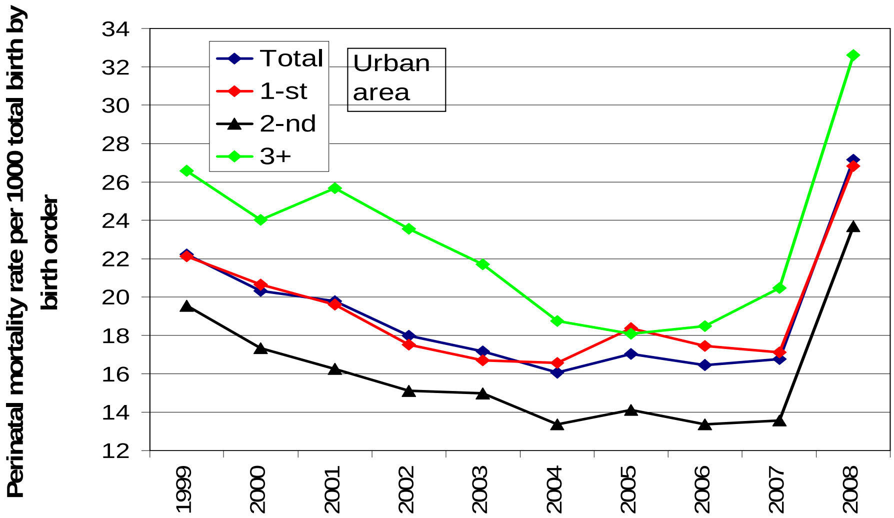
Figure 1g - Crude perinatal mortality rates (in ‰) by age group of mother, urban unmarried, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

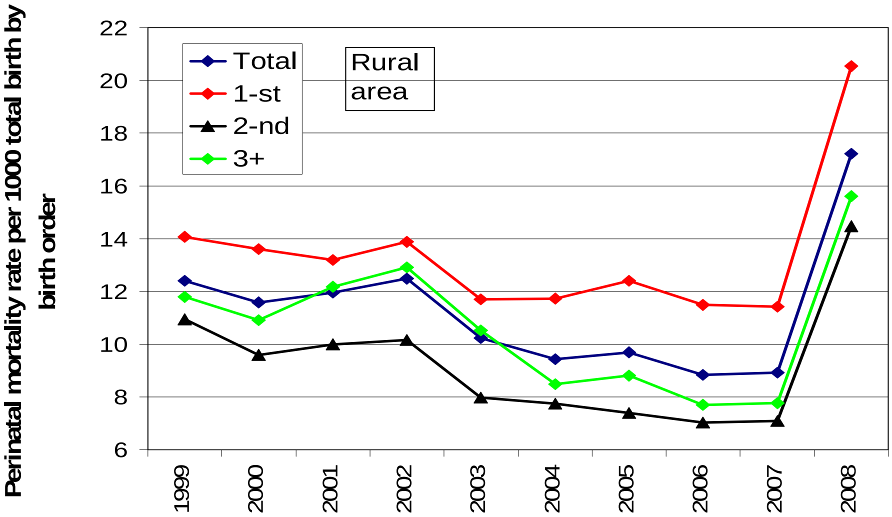
Annex – 2 Crude perinatal mortality rates by child birth order and place of residence of mother

Figure 2a - Crude perinatal mortality rates (in ‰) by child birth order, urban area, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

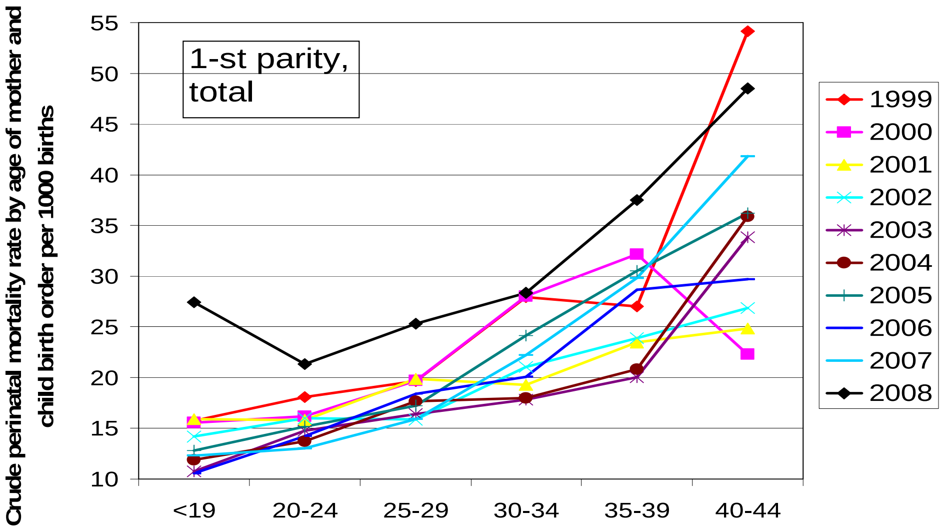
Figure 2b - Crude perinatal mortality rates (in ‰) by child birth order, rural area, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

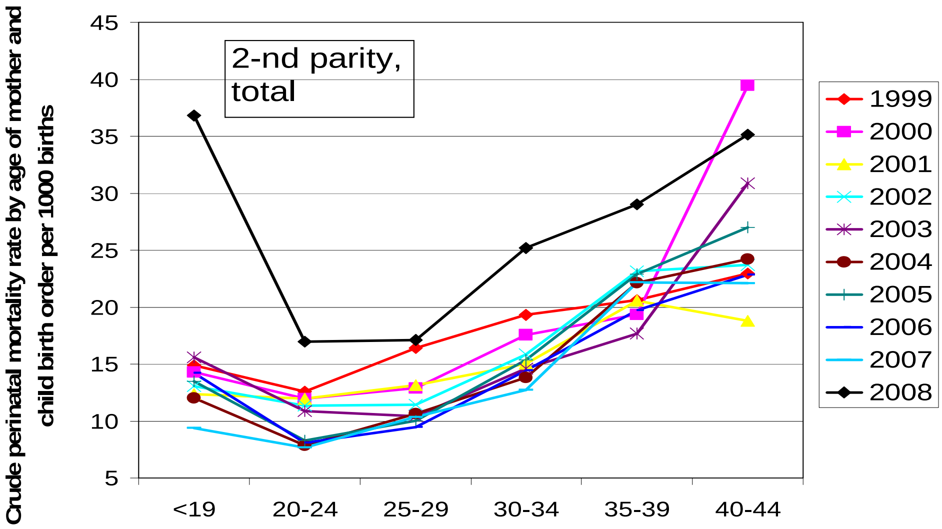
Annex – 3 Crude perinatal mortality rates by age group and child birth order

Figure 3a - Crude perinatal mortality rates (in ‰) by age group of mother, 1-st order, 1999-2008



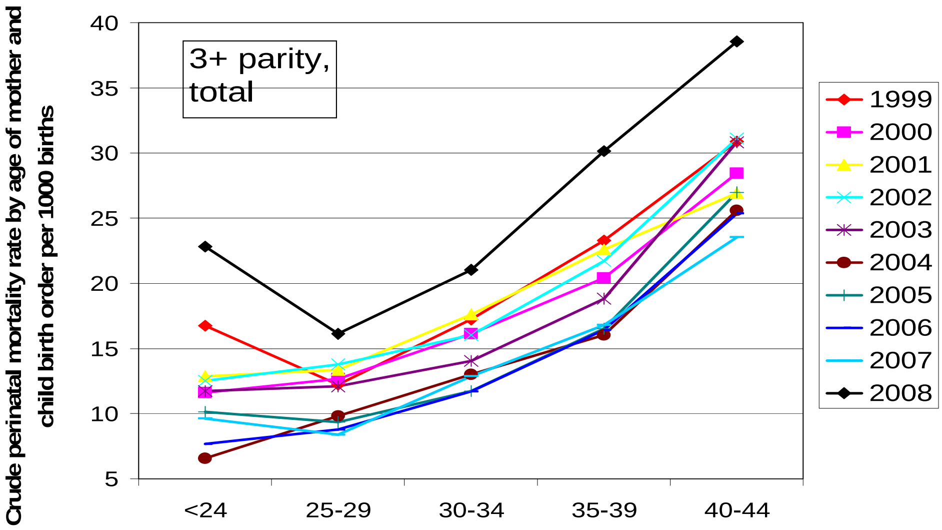
Sources: Unpublished statistical data of Kazakhstan, 2008
Note: Total is for whole Kazakhstan

Figure 3b - Crude perinatal mortality rates (in ‰) by age group of mother, 2-nd order, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008

Figure 3c - Crude perinatal mortality rates (in ‰) by age group of mother, over than 3-rd order, 1999-2008



Sources: Unpublished statistical data of Kazakhstan, 2008