Factors affecting child mortality in Saudi Arabia

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ABSTRACT

الأهداف: لتقدير معدلات واتجاهات وفيات الأطفال وتأثير جنس المولود ونمط المعيشة و المناطق الجغرافية ومستوى تعليم الوالدين على هذه الوفيات.

الطريقة: تم استخدام عينة عشوائية من كافة المناطق في المملكة لتقدير معدلات وفيات الأطفال واتجاهاتها وفروقها وتم تنفيذ الدراسة خلال الفترة فبراير– يونيو٢٠٠٦ واقتصرت العينة المختارة عشوائيا على النساء السعوديات المتزوجات في سن الإنجاب (١٥–٤٩).

النتائج: أظهرت الدراسة انخفاضا كبيرا ومستمرا خلال الفترة ١٩٩٤–٢٠٠٤ فقد انخفض معدل وفيات الأطفال الرضع من ٢٢ لكل ألف مولود حي في عام ١٩٩٤م إلى ١٧ في عام ٢٠٠٤م بينما انخفض معدل وفيات الأطفال أقل من خمس سنوات من ٣٤ لكل ألف مولود حي في عام ١٩٩٤م إلى ٢٢ في عام ٢٠٠٤م واتضح وجود علاقة هامة بين وفيات الأطفال والأطفال الرضع وكل من نمط المعيشة ومستوى تعليم الوالدين.

خاتمة: أثبتت الدراسة الانخفاض المستمر في معدلات وفيات الأطفال خلال فترة الدراسة وأكدت تأثير تعليم الوالدين على هذه المعدلات.

Objectives: To estimate levels and trends, gender differentials, effect of modes of living, regional differentials, and the effect of parental educational on infant and child mortality.

Methods: A nationwide stratified random sample was used to estimate levels, trends and differentials of infant and child mortality in Saudi Arabia. The study was executed during the period February 2006 to June 2006 and covered all the 20 health regions of Saudi Arabia. The randomly selected sample was limited to ever married Saudi women in the reproductive age group (15-49 years).

Results: The findings show a continuous and considerable infant and child mortality decline during the 1994-2004 period. The infant mortality rate has decline from 22 per 1000 live births in 1994 to 17 per 1000 live births in 2004; while the child mortality rate has declined from 34 to 22 per 1000 live births in the same period. There is a strong relation between infant and child mortality and the mode of living and parental education.

Conclusions: The study proves the continuous decline of infant and child mortality during the study period and affirms the effect of parental education on these indicators.

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In many countries deaths of infants and children constitute the single largest age category of mortality, this being true for developing as well as for developed countries.[1] This is attributed to the fact that children, specially infants are less resistant to infectious diseases and much affected by unfavorable environmental conditions and accidents compared to people in other age categories.[2] The infant mortality rate (IMR) is used throughout the world as an important health indicator. A reduction in IMR is accepted as an indicator of improvement in socioeconomic status and provision of health care in a community.[3] The effect of infant mortality on the reproductive behavior of women was studied by some researchers.[4,5] A positive association between the mean number of children ever born and the number of child deaths was found in both rural and urban areas of each country. Although recent decades have witnessed significant decline in infant and child mortality in Saudi Arabia, as a result of health awareness in the community, advancement in health services and improvements in environmental sanitation and personal hygiene, yet few studies have been conducted to qualify that decline.[6-8] Both national and international organizations were depending on the available data to

determine the infant mortality rates, a thing which gave a lot of discrepancies in the figures for national and international communities for any given year, this was clear from the annual reports for these 2 parties. The United Nations Children's Fund (UNICEF) in its very recent reports for the year 2005 stated that IMR in Saudi Arabia is 22 per 1000 live births[9] and 21 for the year 2006.[10] The United Nations Development Programme (UNDP) and World Health Organization (WHO) reported the same figures during 2005 and 2006.[11,12] For the national authorities, the Department of Statistics in the Ministry of Health (MOH) has been reporting the figure (19.1 per 1000 live birth) since the year 2000.[13,14] Due to the above mentioned factor and to update these figures through a well designed survey representing the whole population of the kingdom; this study was designed to estimate levels and trends, gender differentials, effect of mode of living, regional differentials, and the effect of parental education on infant and child mortality.

Methods. The present study uses the detailed information on children ever-born (CEB), children surviving (CS) and children dead (CD) by age groups of mother and duration of marriage, collected in a nationwide stratified random sample to estimate levels, trends and differential of infant and child mortality for Saudi Arabia. The study was executed during the period February - June 2006 and covered all the 20 health region of Saudi Arabia. The sample size of each region was proportional to its population. The randomly selected sample was limited to ever-married Saudi women in the reproductive age group (15-49 years). A proportional stratified random sample is designed to assure a representative sample that might be expected under other types of probability sampling. The sample size has been determined to be 10000 Saudi households. The following formula has been used to estimate the sample size:

$$n = \frac{4p\,(100-p)\,d}{(\text{precision required})^2}$$

where "n" refers to the sample size, "p" stands for the estimate of infant mortality, "d" stands for an estimate of the design effect of the sample. A questionnaire has been developed to answer the study questions. The questionnaire consists of 2 main parts. The first part includes background information; the second part consists of Brass-type questions for indirect estimation of infant morta1ity.[15] Brass designed simple questions that can be answered with reasonable accuracy; namely questions on number of CEB and CD separately for sons and daughters. The questionnaires were completed for 10,931 ever-married Saudi women, approximately l.l women per household. The response rate was 96.5%. The Statistical Package for Social Sciences Program (SPSS) was used to process the data with the measures of the central tendency, cross tabulation and analysis of variance. Brass-type technique is used in the present study to obtain IMR and child mortality rates. Brass-type techniques uses the information of CEB and CD cross classified by 5-years age groups of women and by 5-years duration of marriage to obtain infant and child mortality for the 10 years preceding survey. Brass has shown that the probability of dying between birth and age (a) denoted as q(a) can be estimated as:

$$q(a) = [M(x,5)]\,[D(x,5)]$$

where D(x,5) refers to the proportion of children dead to women in age group (x, x+5) and M(x,5) is an age specific factor, called multiplier, which depends on indices of the age pattern of fertility. Under this assumption, the proportion of children dead for women in age groups (15-19), (20-24), (25-29), (30-34), (35-39), (40-44) (45-49) were used to calculate q(a) for values of (a) equal to 1, 2, 3, 5, 10, 15 and 20 respectively. The estimated early childhood mortality rates were obtained using the United Nations Software Package (MORTPAK) for demographic measurement in developing countries.[16] MORTPAK includes 17 applications in the areas of population projections, life tables and stable population construction, graduation of mortality data, indirect mortality estimation, indirect fertility estimation and other indirect procedures for evaluating age distributions and completeness of censuses (United Nations, 2003). In order to overcome the possible observers' errors; standardized training for all coordinators and interviewers was carried out according to standardized guidelines. The training program consisted mainly of 2 parts: 1) Theoretical background: this consisted mainly of lectures and role play, it aimed to orient the field coordinators and filed investigators about the importance of the study, the accuracy needed, the questionnaire and how to fill it. 2) Practical exercise: this is a simulation exercise consisted mainly of the selection of households, under the direct supervision of the central coordinator and his assistants, Households were selected and the questionnaires were filled by the field investigators, revised and edited by the field supervisors, regional and central coordinators, then all the remarks were discussed together to overcome the errors. The Ethical Committee in the Research Department of Ministry of Health has approved the conduct of the study.

The software used in this study was Statistical Package for Social Sciences.

Results. The findings show a continuous and considerable infant and child mortality decline during the period 1994-2004. The IMR has declined from 22 per 1000 live births in 1994 to 17 per 1000 live births in 2004 (**Figure 1**). Under 5 child the mortality rate (CMR) has declined from 34 per 1000 live births in 1994 to 22 per 1000 live births in 2004 (**Figure 2**). The study shows that males have relatively higher IMR compared to females; the rates for the year 2004 being 18 per 1000 live births for boys and 17 per 1000 live births for girls. The present study shows significant differential of infant and child mortality by a) urban\rural setting (**Figure 2**) b) geographical region (**Table 1**) and c) parental education (**Table 2**). The IMR for the urban setting is lower than the corresponding rate for rural settings; the rates for the year 1994 was 21 per 1000 live birth per 1000 live and 24 per live birth respectively. However, the rates are declining and converging during the period 1994 to 2004; the rates for the year 2004 were 15 per 1000 live births for urban settings and 19 per 1000 live birth for rural settings. The urban/rural pattern of child mortality shown in **Figure 2** is not different from the one shown for infant mortality, with urban population having relatively lower child mortality compared to rural population; the rates for the year 1994 was 31 and 38 per 1000 live births respectively. However, the data in **Figure 2** shows that the urban/rural differential decreases as mortality rates decline where the rates for the year 2004 are 19 and 25 per 1000 live births. The present analysis revealed higher infant and child mortality for the Southern and Northern regions and lowest estimate for Eastern region. The rates for the central and western region lie in the middle, representing the national average. The infant and child mortality rates by geographical regions (**Table 1**) reveal lower infant mortality rates for the Eastern region and higher infant mortality rates for the Southern region, the rates for the 2 regions in 1994 were 20 and 29 per 1000 live births for the Eastern and the Southern regions, but these rates are declining and converging during the period 1994-2004; the rates for the year 2004 were 15 and 20 per 1000 live births for the Eastern and the Southern regions. The child mortality rates by regions follow almost the same pattern of regional differential noticed for infant mortality rates. There is a strong negative association between infant and child mortality and parental education. The infant mortality rate for the group of illiterate mothers is 22 per 1000 live births compared to 11 per 1000 live births for the group of mother with secondary education and above for the year 2004. The same pattern of differential applies to father's education, where the infant mortality rate decreases with increasing educational attainment. The rates for the year 2004 were 21 and 11 per 1,000 live births for the group of illiterate fathers and the group of fathers with secondary education. There is also a negative association between child mortality and

Table 1 - Infant and child mortality rates by region, Saudi Arabia, 1994-2004.

Region period	Infant mortality rate		Child mortality rate	
	2004	1994	2004	1994
Southern	20	29	30	46
Northern	19	28	28	44
Eastern	15	20	20	30
Western	17	21	22	31
Central	17	23	23	34

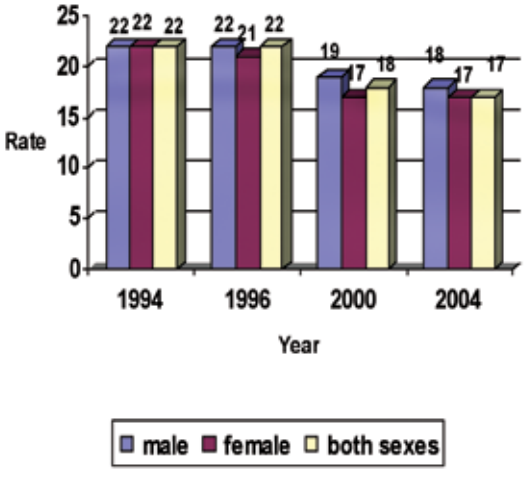

Figure 1 - Infant mortality rates by gender (Saudi Arabia, 1994-2004).

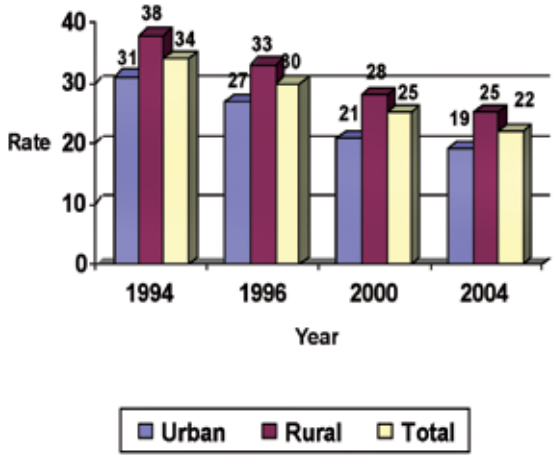

Figure 2 - Under 5 child mortality rates by mode of living (Saudi Arabia 1994-2004.

Table 2 - Infant and child mortality rates by parental education, Saudi Arabia, 1994-2004.

Type	Infant mortality rate				Child mortality rate			
	Mothers education		Father's education		Mothers education		Father's education	
Year	1994	2004	1994	2004	1994	2004	1994	2004
Illiterate	26	22	28	21	45	33	47	33
Read and write	24	19	26	20	42	28	42	30
Primary	21	16	22	17	33	22	33	23
Intermediate	20	13	18	15	29	18	26	20
Secondary	16	11	17	11	22	15	24	16

parental education. However, there is a strong evidence from the findings of the present study that all these differentials are converging as a result of the continuous expansion of health facilities in the Kingdom of Saudi Arabia specially for the disadvantaged groups.

Discussion. The considerable decline of infant mortality shown in **Figure 1** is consistent with the rapid development and progress in several aspects in Saudi Arabia, including the noticeable expansion and continuous progress in medical and health services. During the last 3 decades many hospitals, health centers and social welfare institutions have been established. This period has witnessed huge investment in health programs, improving sanitary and environmental health conditions, and in raising standards of living. Since 1970's, Saudi Arabia has placed more emphasis on the maternal and child care through specialized centers. The primary health care (PHC) program has been implemented since 1984. One of the pillars of PHC programs is the antenatal care and postnatal care services. They also handle routine deliveries in rural settings. Recent years have witnessed considerable improvement for maternal care. The percentage of deliveries attended by doctors and trained nurses in Saudi Arabia is 96%.[17] The relatively low IMR for females is consistent with the finding from other demographic studies and reflect a greater resistance of females to genetic causes of death compared to male births.[18] The data in **Figure 1** shows that the infant mortality rates for females were 17 and males were 18 per 1000 live births. However, the data in **Figure 2** show that the urban/rural differential decreases as mortality rates decline. The relatively higher infant and child mortality in rural areas (compared to urban areas) could be attributed to many factors such as the relatively higher proportion of illiteracy among mothers in rural areas, the short birth intervals, and the too many pregnancies for rural woman that may increase the risk of infant and child deaths. Availability of health services and their utilization in the rural areas is relatively less than that in the urban setting, and the maternal care and nutritional status in the rural areas are lower than that in the urban areas. The infant and child mortality rates by geographical regions are depicted in **Table 1**, which reveals lower IMRs for the Eastern region and higher IMRs for Southern regions, this being true for the period 1994-2004. The 1995 vaccination coverage survey conducted by the Ministry of Health has shown that the immunization coverage in the Southern region is approximately 91% compared to 97% for the Eastern region.[19] Moreover, there is a considerable regional differential with respect to the place of child delivery; the proportion of births delivered at hospital and clinics range from 49% for the Southern region to 91% for the Eastern region.

In conclusion, the observed regional differentials of infant and child mortality appear to reflect the differentials in accessibility to maternal health care and to the differentials of socioeconomic characteristics. There is however a strong evidence that these regional differentials are converging as a result of the continuous expansion of health facilities in all regions of the Kingdom. Previous demographic studies[20-22] have shown that births of educated parents have higher chances of survival than those of non-educated parents; educated mothers seem to have more understanding on the importance of maternal care (during pregnancy, at delivery and during the post-natal period). The father's educational level can be considered as a proxy for the standard of living, the quality of curative services available and utilization. These variations of infant mortality by parental education may be explained by variation in maternal care and immunization. The National Child Health Survey (NCHS) in 1987 shows that approximately 65% of births to women who themselves or their husbands are illiterate, occurred in hospital or clinic, compared to 79% of those whose husbands are literate, 89% of those who themselves are literate.[7] The NCHS has shown that children whose mothers were illiterate or whose fathers were illiterate or have less

than an elementary education displayed lower rates than the average likelihood of being fully immunized while those children whose fathers have at least a secondary education and to greater extent those whose mothers have at least a secondary education, displayed larger rates than the average likelihood of being fully immunized. The study proves the continuous decline of infant and child mortality during the study period and affirms the effect of parental education on these indicators. The IMR has decline from 22 per 1000 live births in 1994 to 17 per 1000 live births in 2004. The CMR has declined from 34 per 1000 live births in 1994 to 22 per 1000 live births in 2004. The last 3 decades have witnessed huge investment in health programs, and significant improvement in sanitary and environmental health conditions and in raising standards of living in Saudi Arabia. Ministry of Health had placed increasing emphasis on the integration of primary and secondary health services and environmental health to cope with rapid socioeconomic transformation in the country. A successful child health program to narrow the infant and child mortality differentials should be based on knowledge of specific circumstances of the various regions and settings, because the differences exists from one region or setting to another in socioeconomic factors, type of diseases, traditions of feeding, and so forth. The relatively high infant and child mortality rates in rural setting and in the Southern region of Saudi Arabia suggest that program for improving maternal and child health care should ensure the expansion of primary health care facilities and better accessibility to health services, and based on community participation, the education of mothers in the context of the cultural and religious characteristics of the population should be emphasized.

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