Study of mortality risk factors for children under age 5 in Abu Dhabi

H.A. Al-Hosani,[1] J. Brebner,[2] A.B. Bener[3] and J.N. Norman[4]

دراسة عوامل اختطار وفيات الأطفال دون الخامسة من العمر في أبوظبي

هـ. الحوسَني، ج. بربنر، أ.ب. بنر، ج.ن. نورمان

الخلاصة: قمنا بدراسة ترابط عوامل الاختطار البيولوجية والاجتماعية والاقتصادية والثقافية مع وفيات الأطفال في أبوظبي في الفترة الممتدة بين الأول من كانون الثاني/يناير وحتى 31 من كانون الأول/ديسمبر من عام 1997. وبالاستعانة باختبار خي مربع لماكنمار، وجد أن أكثر عوامل الاختطار البيولوجية المنتقاة تترابط إحصائياً بوفيات الأطفال، إلا أن تقدُّم الأمهات بالسن لأكثر من 40 سنة وسوابق وفيات الأجنة لديهن لم يكن لهما ارتباط إيجابي بمعدل وفيات الوِلْدان والأطفال دون الخامسة من العمر. ومن بين عوامل الاختطار الاجتماعية والاقتصادية والثقافية، فإن فقدان الأمهات للتعليم النظامي والدخل الشهري المنخفض يترافقان مع وفيات الأطفال. فيما ترافق زواج الأقارب بشكل هام مع وفيات حديثي الولادة، في حين كان الحمل الذي تقل فترته عن 37 شهراً مترافقاً إلى حد بعيد بمعدلات وفيات بين جميع الأعمار. لذلك ينبغي أن تتمثل الأولويات في تعزيز برامج الرعاية الصحية والتأكيد على الحاجة لتعريف المجموعات المعرَّضة لأخطار مرتفعة.

ABSTRACT We investigated the association of biological, sociocultural and economic risk factors with child mortality in Abu Dhabi from 1 January–31 December 1997. With McNemar chi-squared test, most selected biological risk factors were statistically associated with child mortality, although maternal age older than 40 years and history of fetal death were not positively correlated with neonate, infant or age under 5 mortality. Among sociocultural and economic risk factors, maternal lack of formal education and low monthly income were significantly associated with child death. Consanguinity was significantly associated with under 5 and infant but not neonatal mortality. Gestation < 37 weeks was highly associated with mortality among all ages. Strengthening health care programmes and emphasizing the need to identify high risk groups should be priorities.

Etude des facteurs de risque de mortalité pour les enfants de moins de cinq ans à Abu Dhabi
RESUME Nous avons étudié l'association entre les facteurs de risque économiques, socioculturels et biologiques, et la mortalité infantile à Abu Dhabi du 1er janvier au 31 décembre 1997. Avec le test khi-carré de McNemar, la plupart des facteurs de risque biologique retenus étaient associés statistiquement à la mortalité infantile ; cependant, l'âge de la mère supérieur à 40 ans et les antécédents de décès fœtal n'étaient pas corrélés positivement avec la mortalité des nouveau-nés, des nourrissons et des enfants de moins de cinq ans. Parmi les facteurs de risque socioculturels et économiques, le manque d'instruction de la mère et le faible revenu mensuel étaient associés positivement au décès infantile. La consanguinité était associée significativement à la mortalité néonatale. Une gestation de moins de 37 semaines était fortement associée à la mortalité dans tous les groupes d'âge. Le renforcement des programmes de soins de santé et l'identification des groupes à haut risque devraient être des priorités.

[1]*Central Department of Maternal and Child Health, Ministry of Health, Abu Dhabi, United Arab Emirates.*
[2]*Department of General Practice, Foresterhill Health Centre, University of Aberdeen, Aberdeen, Scotland.*
[3]*Faculty of Medicine and Health Science, United Arab Emirates University, Al-Ain, United Arab Emirates.*
[4]*School of Medicine, General Practice and Primary Care, University of Aberdeen, Aberdeen, Scotland.*
Received: 03/07/02; accepted: 24/12/02

Introduction

Understanding infant mortality in a community requires two components: the neonatal mortality rate, which is the number of deaths occurring within 28 days after birth per 1000 neonates, and the postnatal mortality rate, which is the number of deaths from 28 days to less than 1 year after birth per 1000 infants. The under 5 mortality rate is the annual number of deaths of children under age 5 per 1000 births. It measures the probability of dying between birth and exactly 5 years of age. The United Nations Children's Fund (UNICEF) considers it the best single indicator of social development and well being as the rate reflects income, nutrition, health care and basic education in a community [*1*].

The United Arab Emirates (UAE) has experienced a substantial decline in child mortality rates during the 10 years from 1990–1999. During that period, neonatal mortality declined from 7.7 to 5.18 per 1000 live births, infant mortality from 11.4 to 6.56 per 1000 and under age five mortality from 14.4 to 11.8 per 1000 [*2*]. According to the Gulf Family Health Survey from 1992 to 1996 in Qatar the neonatal mortality rate was 5.2 per 1000 live births, infant mortality was 10.2 per 1000 and children under five mortality was 15.2. In Saudi Arabia the neonatal mortality rate was 11.7 per 1000 live births, infant mortality was 21.4 and children under five mortality was 29.0. In Oman, the neonatal mortality rate was 8.0 per 1000 live births, while mortality rates for infants and children under five were 14.3 and 20.0 per 1000 live births respectively [*3*].

The problem of infant and preschool mortality is multifactorial as single factors seldom operate in isolation. These factors can be biological or socioeconomical, although the distinctions between them are often made only for convenience. A high infant mortality rate among a vulnerable population may be due to the interaction of these biological, environmental and social risks [*4*]. Some risk factors like maternal age, birth order and prenatal care are modifiable while others like ethnicity and sex are not [*5*].

Evidence from developing countries relates infant mortality to socioeconomic development. Poverty, ignorance, isolation, lack of basic services and excessive fertility may make children more vulnerable to disease and hinder access to and reduce the efficacy of medical services [*6*]. The situation is different in industrialized countries where adequate medical care and a high standard of living were achieved long ago [*7*].

The neonatal death rate is determined by endogenous factors such as low birth weight and congenital disorders. By contrast, post neonatal mortality is determined more by exogenous factors, i.e. environmental and social factors [*8*]. Maternal age under 20 years, for example, is a significant risk factor for neonatal and post neonatal mortality. Mortality rates are also higher among infants born to adolescents than among those born to older women [*9,10*]. Furthermore, risk is associated with high birth parity and closely spaced pregnancies. This is consistent with the maternal depletion hypothesis in that women with many prior births may experience nutrition depletion that then contributes to the poor health of subsequent births [*11*].

Understanding the roles that specific risk factors play may help to reduce child mortality rates. Identifying their relative importance and interplay is essential when setting priorities and allocating resources. This study, therefore, investigated the

influence of important risk factors on mortality rates for children less than 5 years old in Abu Dhabi, UAE.

Methods

Cases were all deaths among neonates (aged 0–4 weeks), infants (> 4 weeks and ≤ 12 months) and under fives (children > 12 months and ≤ 5 years) from 1 January to 31 December 1997 in Abu Dhabi Emirate.

A matched pair design using 4 variables, i.e. date of birth, sex, nationality and region, was used to select control samples. The Birth Registry Book was used to identify 3 living 'potential controls' of the same sex, nationality and group and born with 7 days of birth of each case in order to eliminate the effect of seasonal differences as a risk of death. We chose 3 controls to compensate for the absence of a family through temporary travel or permanent departure from the country. Telephone numbers of the parents were obtained from the birth registry.

A standardized questionnaire was designed to collect data for both cases and controls, and death certificates were used to obtain further information about the circumstances surrounding child deaths. Information was collected on selected biological and obstetric risk factors in addition to sociocultural and economic factors. The selected biological risk factors were parental age, gravidity, parity, birth order, birth weight, birth interval, duration of gestation, history of fetal death, history of deaths among siblings and health of the baby at birth. Sociocultural and economic data included paternal education, maternal occupation, monthly income, crowding index and consanguinity. Crowding index was defined as: [(1/2 number of children under age 10) + (number of couples) + (all other household residents)]/number of bedrooms in the home [*12*].

For most variables, information was gathered through personal interview although some information was obtained from the mother's hospital file or the death notification sheet. The mother of each deceased child was interviewed either by telephone or via home visits with a trained fieldworker if there was no response by telephone. A total of 255 child deaths were recorded during the study. Data collection was incomplete for 27 deaths (10.6%). The present study, therefore, was based on 228 child deaths, or a response rate of 89.4%. This response rate was satisfactory.

Data were analysed using *STATA* for Windows, version 5.0. Differences between groups of potential risks and deaths were tested with McNemar chi-squared and odds ratio with 95% confidence intervals for the degree of association [*13*]. Logistic regression identified the most independent variables associated with child death categories. Dependent variables were child under age 5 mortality, infant mortality and neonatal mortality. Table 1 shows the independent variables and the categories used in logistic regression.

Results

Tables 2–4 show that most selected biological risk factors were positively associated with child mortality. Maternal age under 20 years, paternal age under 26 years, first born (first pregnancy and/or first delivery), birth weight under 2500 g, short interval since last pregnancy (< 24 months), preterm delivery (< 37 weeks), history of previous deaths among siblings and ill health at birth were statistically associated

Table 1 **Independent variables used in logistic regression**

Variable	Category
Maternal age	A continuous variable
Maternal education	An ordinal variable
Parity	A continuous variable
Birth weight	A continuous variable
Interval since last pregnancy	< 24 months vs. 24+ months
History of deaths among brothers/sisters	Similar death vs. no history
Duration of gestation	A continuous variable
Monthly income	An ordinal variable
Consanguinity	Related vs. did not have

with deaths in the 3 groups. Maternal age over 40 years and history of fetal deaths were not significantly correlated with any child mortality rates. High parity and high birth order were significant only with mortality rates for under fives (Table 2). Birth order was not significantly associated with infant mortality (Table 3).

Tables 5–7 show univariate analyses between selected sociocultural and economic risk factors and child mortality rates. Absence of maternal formal education, monthly income < 6000 UAE dirhams (US$ 1 = 3.68 dirhams) and consanguinity were positively associated with child deaths. Although consanguinity was significant for infants and under fives, it was not significant among neonatal deaths, possibly reflecting the effect of relatively small numbers of case–control pairs (Table 7). Paternal education, working for cash and crowding index had no significant association with deaths in the 3 groups.

Tables 8–10 show the results of conditioned logistic regression for child mortality. All independent variables with a statistically significant association with the corresponding mortality rate were used in the regression. Spacing of less than 24 months, history of deaths among siblings and short gestation were statistically significant risk factors associated with all child mortality groups. The effects of maternal age and parity were concealed by the presence of the highly correlated variables of spacing and occurrence of deaths among siblings. The effect of birth weight was concealed by duration of gestation (Table 8). Consanguinity was a statistically significant risk factor associated only with under five mortality; low birth weight was a statistically significant risk factor associated only with infant mortality (Tables 8 and 9). Low income was not significantly associated with neonatal mortality (Table 10).

Discussion

In our study, certain sociobiological determinants were risk factors associated with child mortality. Of the biological risk factors, young maternal age, first pregnancy, first birth or delivery, low birth weight, < 24 months interval since last pregnancy, pre-term birth, history of previous deaths among siblings and ill health at birth were significantly associated with all 3 child mortality groups (Tables 2–4). The only socioeconomic risk factors having significant association with child death categories were lack of formal maternal education and relatively low income (Tables 5–7).

Infants and children born to young mothers under age 20 were significantly exposed to the risks of mortality. The effect of maternal age was significant in each of the 3 groups of child mortality. Adverse effects of extremes of maternal age upon the health of the newborn, infant and child have been reported in the literature and are described as a U-shaped

Table 2 **Univariate analysis odds ratios (OR) with 95% confidence intervals (CI) of biological risk factors for children under 5 mortality rates (n = 228)**

Risk factor	High risk group	Proportion		McNemar χ^2	OR, 95% CI
		Among cases (%)	Among controls (%)		
Maternal age (years)	< 20	12.7	1.8	20.60**	9.39, 2.88–47.97
	40+	6.6	7.5	0.14	0.87, 0.38–1.95
	< 20, 40+	19.3	9.3	8.97**	2.28, 1.28–4.21
Paternal age (years)	< 26	13.6	7.5	4.9**	2.08, 1.04–4.38
Gravidity	1	21.9	12.7	7.23**	2.05, 1.17–3.69
	7+	17.5	24.1	3.36	0.63, 0.37–1.06
	1, 7+	39.4	36.8	0.35	1.12, 0.75–1.75
Parity	1	26.3	14.5	10.57**	2.29, 1.34–4.02
	7+	12.7	20.6	5.59**	0.52, 0.29–0.93
	1, 7+	39.0	35.1	0.79	1.19, 0.79–1.79
Birth order	1	23.2	14.5	6.46**	1.95, 1.13-3.48
	7+	14.0	20.6	3.95**	0.87, 0.38–1.95
	1, 7+	37.2	35.1	0.26	1.11, 0.73–1.70
Birth weight	< 2500 g	38.2	5.3	64.7**	13.5, 5.94–37.87
Interval since last pregnancy	< 24 months	81.0	49.4	31.5**	4.33, 2.44–8.18
Duration of gestation	< 37 weeks	77.6	5.3	163.02**	166, 29.4–6596.10
History of fetal death	Positive	45.6	46.8	0.6	0.94, 0.57–1.55
Previous deaths among siblings	Positive	17.5	3.9	13.3**	4.5, 1.82–13.33
Health status at birth	III	39.5	5.3	69.14**	16.6, 6.84–52.47

Statistically significant at P < 0.05.
***Statistically significant at P < 0.01.*

pattern with higher risk at extremes of maternal age [*14*]. The significant association between young maternal age and the risk of child mortality was more similar to the pattern in most industrialized countries than that in most developing countries [*11,15,16*]. The effect of young maternal age on mortality in our study might be explained by lack of child care experience; because of the high standard of living in this country, economic factors were not likely to play a part.

Most studies of the effect of parental age on child mortality focus mainly on the age of the mother with the assumption that paternal age is of little importance. We found that paternal age statistically acts through maternal age and its effect is explained by positive correlations between it and maternal age (r = 0.74).

Table 3 **Univariate analysis odds ratios (OR) with 95% confidence intervals (CI) of biological risk factors for infant mortality (*n* = 183)**

Risk factor	High risk group	Proportion		McNemar χ^2	OR, 95% CI
		Among cases (%)	Among controls (%)		
Maternal age (years)	< 20	13.1	2.2	15.38**	7.67, 2.32–39.89
	40+	4.9	7.1	0.89	0.64, 0.21–1.80
	< 20, 40+	18.0	9.3	5.82*	2.14, 1.10–4.37
Paternal age (years)	< 26	15.3	8.2	4.83*	2.18, 1.03–4.93
Gravidity	1	22.4	14.2	4.41*	1.83, 1.00–3.45
	7+	16.9	23.0	2.12	0.68, 0.34–1.18
	1, 7+	39.3	37.2	0.19	1.10, 0.70–1.72
Parity	1	27.3	15.8	7.43*	2.1, 1.19–3.85
	7+	12.6	19.7	3.45	0.58, 0.31–1.07
	1, 7+	39.9	35.5	0.74	1.21, 0.77–1.89
Birth order	1	24.0	16.4	3.77	1.74, 0.96–3.23
	7+	13.7	19.7	2.47	0.63, 0.34–1.16
	1, 7+	37.7	36.1	2.47	1.08, 0.68–1.72
Birth weight	< 2500 g	42.6	6.6	55.8**	12.0, 5.25–33.78
Interval since last pregnancy	< 24 months	77.4	48.4	20.9**	3.77, 2.01–7.57
Duration of gestation	< 37 weeks	80.3	6.0	134.03**	137, 24.2–5450.50
History of fetal death	Positive	43.5	44.4	0.2	0.97, 0.57–1.65
Previous deaths among siblings	Positive	15.3	4.9	9.76**	3.11, 1.43–7.49
Health status at birth	III	42.6	6.6	57.32**	14.2, 5.81–45.08

**Statistically significant at P < 0.05.*
***Statistically significant at P < 0.01.*

An association between infant mortality and increased parity has been found. In India the risk of infant mortality increased after the third birth and the fate of the fifth child was always worse than the third [*8*]. In the United States of America infants of adolescent multipara were twice as likely to die after the first month of life than the infants of adolescent primipara [*17*]. The significant association between first born (first pregnancy and/or first delivery) and increased risk of mortality for under fives may be peculiar to the community of the UAE as it is contrary to what has been commonly reported in the medical literature.

Low-birth-weight infants (< 2500 g) were at increased risk (13.5 times higher than normal-birth-weight infants) before they reached their fifth birthday. Many

Table 4 **Univariate analysis odds ratios (OR) with 95% confidence intervals (CI) of biological risk factors for neonatal mortality (n = 119)**

Risk factor	High risk group	Proportion		McNemar χ^2	OR, 95% CI
		Among cases (%)	Among controls (%)		
Maternal age (years)	< 20	11.7	0.0	14.0**	∞, 3.32–∞
	40+	5.9	8.4	0.60	0.67, 0.20–2.10
	< 20, 40+	17.6	8.4	4.17*	2.22, 0.97–5.54
Paternal age (years)	< 26	16.8	4.2	11.84**	8.5, 2.02–75.86
Gravidity	1	23.5	11.8	6.12**	1.83, 1.00–3.45
	7+	20.2	26.9	1.52	0.68, 0.34–1.18
	1, 7+	43.7	38.7	0.60	1.10, 0.70–1.72
Parity	1	28.6	13.4	8.53**	2.8, 1.32–6.46
	7+	14.3	23.5	3.27	0.54, 0.27–1.11
	1, 7+	42.9	37.0	0.80	1.26, 0.73–2.17
Birth order	1	25.2	14.3	5.12**	2.3, 1.05–5.41
	7+	16.0	23.5	2.19	0.61, 0.29–1.23
	1, 7+	41.2	37.8	0.29	1.15, 0.66–2.03
Birth weight	< 2500 g	45.4	5.0	44.31**	25, 6.6–212.10
Interval since last pregnancy	< 24 months	79.3	46.3	17.78**	4.86, 2.12–12.98
Duration of gestation	< 37 weeks	83.2	7.6	88.04**	91, 15.9–3633.30
History of fetal death	Positive	47.6	46.3	0.03	1.05, 0.53–2.08
Previous deaths among siblings	Positive	16.8	3.4	10.67**	5.0, 1.68–20.12
Health status at birth	III	41.2	7.6	34.48**	14.33, 4.59–72.22

Statistically significant at P < 0.05.
**Statistically significant at P < 0.01.*

researchers have confirmed this association [*11, 18*]. Univariate analysis of the selected biological risk factors revealed that pre-term births (< 37 weeks) and ill health at birth were strongly associated with child mortality (Tables 2–4). This was similar to a 1994 study in which birth weight and gestational age strongly affected neonatal, post neonatal and infant mortality [*9*].

Maternal lack of formal education and low monthly income (< 6000 UAE dirhams/month) were significantly associated with child mortality in our study (Tables 5–7). In India where the post neonatal mortality rate was nearly 5 times higher among newborns of illiterate mothers than among those with more than elementary education, maternal education was the most important single factor contributing to the

Table 5 **Univariate analysis odds ratios (OR) with 95% confidence intervals (CI) of selected social, cultural and economic risk factors for children aged under 5 mortality (*n* = 228)**

Risk factor	High risk group	Proportion		McNemar χ^2	OR, 95% CI
		Among cases (%)	Among controls (%)		
Maternal age (years)	< 20	13.1	2.2	15.38**	7.67, 2.32–39.89
Maternal education	No formal education	24.6	16.7	4.91*	1.75, 1.03–3.02
Paternal education	No formal education	13.6	13.2	0.02	1.05, 0.55–2.00
Paternal occupation	Working for cash	16.7	17.5	0.06	0.94, 0.56–1.57
Monthly income	< 6000 dirhams/month	64.5	49.6	12.48**	2.21, 1.40–3.59
Crowding index	> 2	23.7	20.2	0.78	1.22, 0.76–1.93
Consanguinity	Positive	53.9	37.3	12.89**	2.03, 1.35–3.09

3.68 UAE dirhams = US$ 1. **Statistically significant at P < 0.05.* ***Statistically significant at P < 0.01.*

Table 6 **Univariate analysis odds ratios (OR) with 95% confidence intervals (CI) of selected social, cultural and economic risk factors for infant mortality (*n* = 183)**

Risk factor	High risk group	Proportion		McNemar χ^2	OR, 95% CI
		Among cases (%)	Among controls (%)		
Maternal education	No formal education	23.0	15.3	4.08*	1.82, 0.98–3.51
Paternal education	No formal education	14.2	12.0	0.44	1.25, 0.62–2.58
Paternal occupation	Working for cash	16.9	16.9	0.0	1.0, 0.55–1.81
Monthly income	< 6000 dirhams/month	66.1	52.5	9.06**	2.14, 1.26–3.72
Crowding index	> 2	23.5	21.3	0.24	1.13, 0.68–1.87
Consanguinity	Positive	54.1	37.7	10.0**	2.0, 1.27–3.21

3.68 UAE dirhams = US$ 1. **Statistically significant at P < 0.05.* ***Statistically significant at P < 0.01.*

Table 7 **Univariate analysis odds ratios (OR) with 95% confidence intervals (CI) of selected social, cultural and economic risk factors for neonatal mortality (*n* = 119)**

Risk factor	High risk group	Proportion		McNemar χ^2	OR, 95% CI
		Among cases (%)	Among controls (%)		
Maternal education	No formal education	26.9	16.8	4.24*	2.09, 0.98–4.75
Paternal education	No formal education	16.8	13.4	0.57	1.33, 0.59–3.09
Paternal occupation	Working for cash	16.8	18.5	0.12	0.88, 0.41–1.88
Monthly income	< 6000 dirhams/month	65.5	52.1	5.57*	2.07, 1.08–4.12
Crowding index	> 2	26.1	24.4	0.08	1.08, 0.60–1.97
Consanguinity	Positive	52.9	42.9	2.57	1.55, 0.88–2.77

3.68 UAE dirhams = US$ 1. **Statistically significant at P < 0.05.* ***Statistically significant at P < 0.01.*

Table 8 **Logistic regression odds ratio (OR) with 95% confidence intervals (CI) for children aged under 5 mortality**

Variable	OR	95% CI
Maternal age	1.00	0.92–1.09
Maternal education	0.83	0.59–1.18
Parity	1.10	0.84–1.43
Birth weight	0.999	0.998–1.001
Interval since last pregnancy*	2.74	2.54–2.95
History of fetal death*	3.86	2.64–5.65
Duration of gestation*	0.60	0.50–0.74
Monthly income*	0.45	0.27–0.77
Consanguinity*	3.59	1.37–9.42

**Significant at P < 0.05.*

Table 9 **Logistic regression odds ratios (OR) with 95% confidence intervals (CI) for infant mortality**

Variable	OR	95% CI
Maternal age	0.99	0.90
Maternal education	0.83	0.51–1.27
Parity	1.16	0.58–1.59
Birth weight*	0.999	0.998–1.000
Interval since last pregnancy*	2.29	2.28–3.30
History of fetal death*	1.33	1.11–1.61
Duration of gestation*	0.56	0.43–0.74
Monthly income*	0.52	0.28–0.96
Consanguinity	2.83	0.97–8.28

**Significant at P < 0.05.*

Table 10 **Logistic regression odds ratios (OR) with 95% confidence intervals (CI) for neonatal mortality**

Variable	OR	95% CI
Maternal age	0.95	0.79–1.14
Maternal education	0.60	0.19–1.89
Parity	1.07	0.71–1.62
Birth weight	1.00	0.999–1.001
Interval since last pregnancy*	6.09	4.29–8.64
History of fetal death*	50.59	4.57–560.21
Duration of gestation*	0.17	0.04–0.72
Monthly income	1.05	0.02–1.05

**Significant at P < 0.05.*

reduction of post neonatal mortality [*19*]. Many studies have indicated that monthly income is associated with infant vulnerability and mortality [*4,6,20*]. The association between income and under five mortality may be attributed to the infrequent use of health facilities by low income families even when health services are accessible.

Consanguineous marriage was a risk factor for infant and under 5 mortality (Tables 5 and 6). Studies in some industrialized and developing counties have reported that offspring of consanguineous parents have increased morbidity and mortality in infancy and childhood [*21–23*].

Logistic regression analysis of independent variables confirmed the significant association of interval since mother's last pregnancy, history of death among siblings and duration of gestation with mortality rates for all 3 age groups (Tables 8–10).

Conclusion

Our study examined the strong association and impact of biological risk factors on child mortality. Short gestation (< 37 weeks) and ill health at birth respectively increased mortality risks 166 and 16.6 times higher than children born at term and

delivered healthy. Low-birth-weight infants (< 2500 g) had a mortality risk 25 times higher than babies of normal birth weights before they reached their first birthday. Among sociocultural factors, only the lack of maternal formal education and low monthly income were significantly correlated to child mortality rates.

More effort is needed to monitor and evaluate the effectiveness of current health care programmes. Early identification of high risk pregnancies should be stressed.

References

1. Cassens BJ. *Preventive medicine and public health*, 2nd ed. Baltimore, Maryland, Wilkins, 1998:1–12.
2. *Annual statistical book*. Abu Dhabi, United Arab Emirates, Ministry of Health, 1999.
3. *Gulf family health survey. Preliminary report*. Abu Dhabi, UAE, Council of Health Ministries of Gulf Co-operation Council states, Ministry of Health, 1995.
4. Nersesian WS. Infant mortality in socially vulnerable populations. *Annual review of public health*, 1988, 9:361–77.
5. McCormick MC. The contribution of low birth weight to infant mortality and childhood mortality. *New England journal of medicine*, 1985, 312:82–90.
6. Bixby LR. Infant mortality in Costa Rica: explaining the recent decline. *Studies in family planning*, 1986, 17:57–65.
7. Hamvas A et al. The influence of wider use of surfactant therapy on neonatal mortality among blacks and whites. *New England journal of medicine*, 1996, 334: 1635–40.
8. Park K. *Park's textbook of preventive and social medicine*, 14th ed. Jabalpur, India, Banarsides Bahanot, 1995.
9. Geronimus AT. On teenage childbearing and neonatal mortality in the United States. *Population and development review*, 1987, 13:245–79.
10. National Center for Health Statistics. Infant mortality by birth weight and other characteristics: United States, 1985 birth cohort. *Vital health statistics*, 1994, 20:24.
11. Singh GK, Kposowa AJ. A comparative analysis of infant mortality in major Ohio cities: Significance of socio-biologic factors. *Applied behavioral science review*, 1994, 2(1):77–94.
12. Morrison PS. Housing occupancy and the changing size of households and dwellings in New Zealand, 1951–1991. *New Zealand population review*, 1994, 10(1–2):69–100.
13. McNemar Q. A note on the error of the difference between correlated proportions or percentages. *Psychometrika*, 1974, 12:153–7.
14. Chandrasekhar S. *Infant mortality, population growth and family planning in India*. London, George Allen and Unwin Ltd, 1971: 129–85.
15. Wegman ME. Infant mortality: Some international comparisons. *Pediatrics*, 1996, 98(6):1020–7.
16. Harfouche JK, Verhoestrate L, Al-Shazali H. *The state of child health in the Eastern Mediterranean Region*. Alexandria, World Health Organization Regional Office for the Eastern Mediterranean, 1985:153–299 (WHO/EMRO Technical Publication Series, no. 9).

17. Kleinman JC, Kiely JL. Post-neonatal mortality in the United States: an international perspective. *Pediatrics*, 1990, 86:1091–7.

18. Brittain AW. The effect of parental age, birth order and other variables on early childhood mortality: a Caribbean example. *Social science and medicine*, 1992, 35:1259–71.

19. Vaidyanathan K. *Studies on mortality in India*. India, Gandhigram Institute of Rural Health and Family Planning, 1972: 199.

20. Tresserras R et al. Infant mortality, per capita income and adult illiteracy: an ecological approach. *American journal of public health*, 1992, 82(3):435–7.

21. Hafez M et al. Consanguineous mating in the Egyptian population. *Journal of medical genetics*, 1983, 20:58–60.

22. Khoury JM et al. Inbreeding and prereproductive mortality in the Old Order Amish. *American journal of epidemiology*, 1987, 125:453–82.

23. Druschel C, Hughes JP, Olsen C. Mortality among infants with congenital malformations in New York State, 1983–1988. *Public health reports*, 1996, 111(4):359–65.

Integrated Management of Childhood Illness

Each year more than 10 million children in low- and middle-income countries die before they reach their fifth birthday. Seven in ten of these deaths are due to just five preventable and treatable conditions: pneumonia, diarrhoea, malaria, measles, and malnutrition, and often to a combination of these conditions.

Every day, millions of parents seek health care for their sick children, taking them to hospitals, health centres, pharmacists, doctors and traditional healers. Surveys reveal that many sick children are not properly assessed and treated by these health care providers, and that their parents are poorly advised.

These factors make providing quality care to sick children a serious challenge. WHO and UNICEF have addressed this challenge by developing a strategy called Integrated Management of Childhood Illness (IMCI).

Further information about IMCI can be obtained on line at: http://www.who.int/child-adolescent-health/Integr.htm