journal of global health Reports

Maternal empowerment and healthcare access determines stillbirths and early neonatal mortality in Pakistan: analysis of demographic and health survey 2012-13

Jamil Ahmed[1,2], Ashraful Alam[1], Camille Raynes-Greenow[1]

Background To determine how a lack of women's empowerment affects their risk of stillbirths and early neonatal mortality in Pakistan.

Methods Pakistan Demographic and Health Survey 2011-12 data were used to analyse 11,985 and 11,596 singleton births in the 5 years preceding the survey, respectively, for stillbirth and early neonatal mortality. Multivariate logistic models, adjusted for survey cluster were performed in STATA (Stata Inc, College Station, TX, USA) using step-wise backward elimination to measure associated factors of stillbirth and early neonatal mortality in separate models. Results are presented as adjusted odds ratios (aOR).

Results Women whose family elders made their healthcare decisions compared to women who decided for themselves had higher odds of stillbirth (aOR=2.04, 95% confidence interval (CI)=1.05-3.99). Women who had never used any family planning, compared to modern methods were 1.47 times more likely to have experienced a stillbirth (aOR=1.47, 95% CI=1.06-2.04). Women who did manual labour compared to no work (aOR=1.55, 95% CI=1.09-2.21), or were a blood relation with their husband also had higher odds of stillbirth (aOR=1.45, 95% CI=1.01-2.06). Early neonatal mortality was explained mainly by mothers facing financial problems to access to treatment (aOR=1.67, 95% CI=1.06-2.63), babies not weighed at birth (aOR=4.39, 95% CI=1.00-19.33), malnourished mothers (body mass index BMI <18.5, aOR=1.61, 95% CI=1.00-2.58) and mothers who wanted their last child later than when they were born (aOR=0.17, 95% CI=0.05-0.59).

Conclusions: Women's empowerment to choose and access healthcare for themselves and their newborns during pregnancy and birth should be the cornerstone of any intervention package to tackle stillbirths and early neonatal mortality in a high burden country like Pakistan.

[1]Sydney School of Public Health, The University of Sydney, Sydney, Australia
[2]Department of Family and Community Medicine, College of Medicine and Medical Sciences, Arabian Gulf University, Bahrain

Cite as: Ahmed J, Alam A, Raynes-Greenow C. Maternal empowerment and healthcare access determines stillbirths and early neonatal mortality in Pakistan: analysis of demographic and health survey 2012-13. J Glob Health Rep 2018; 2: e2018030.

CORRESPONDENCE TO:
Jamil Ahmed | PhD Candidate Medicine | School of Public Health | Sydney Medical School | The University of Sydney | Room 121B, Edward Ford Building (A27) | Sydney, NSW | 2006 Australia
Assistant Professor | Department of Family and Community Medicine | College of Medicine and Medical Sciences | Arabian Gulf University | Salmaniya Medical Complex, Manama, Bahrain
jahm3675@uni.sydney.edu.au

Stillbirths and early neonatal mortality continue to be a huge public health challenge in developing countries, despite an overall global reduction of under-five child mortality and stillbirth (*1*). In 2011, the global burden of third trimester stillbirths was 2.6 million, and data reported in 2015 estimated that early neonatal mortality was ~2 million babies a year (*2*). Of the neonatal deaths, almost three quarters, occur in first week of life, most within the first 48 hours (*3*). The 2020 global targets for early neonatal morality and stillbirth are set at less than 15 and 14 per 1000 births by the year 2020 but for many low and middle-income countries, this will be challenging (*1*).

Low- and middle-income countries account for the greatest burden of perinatal mortality (*4*). These countries including Pakistan and neighbouring India and Bangladesh share a large burden of perinatal mortality along with Sub-Saharan African countries. In 2015 Pakistan had an estimated 242,600 stillbirths at a rate of approximately 43 per 1000 births - the highest in the world. Similarly there were 244,700 neonatal deaths (*5*, *6*) with a neonatal mortality rate of 40 per 1000 live births, (*7*) the highest in the Eastern Mediterranean region (*8*). Recent nationally representative surveys in Pakistan, have reported even higher rates. The 2012 Pakistan demographic and health survey (DHS) reported a perinatal mortality rate of 75 per 1,000 births with very little progress since the 2007 DHS (*9*). The causes of the high burden of perinatal deaths in countries like Pakistan are multifaceted. In Pakistan, antepartum maternal disorders including hypertension, haemorrhage and other maternal conditions account for almost a quarter of stillbirths. Intrapartum asphyxia accounts for another quarter and the remaining antepartum cases are usually unexplained (33%) or intrapartum unexplained (21%) causes. These unexplained intrapartum deaths could be because of congenital anomalies, intrapartum hypoxia, preterm labour and intrapartum infections (*10*). Intrapartum stillbirths are especially linked with the delay and poor quality of health services around birth. The quality of and access to the health services by rural women is the main reason for the high stillbirth burden in the intrapartum period in South Asia (*5*). As for neonatal mortality, infections, preterm birth and birth asphyxia account for almost all of neonatal deaths in high burden countries like Pakistan (*11*). However preterm birth is the main cause of early neonatal mortality and is also the primary cause of under-5 child mortality globally, including in Pakistan (*7*). Neonatal birth asphyxia because of labour complications causes about a third of all neonatal deaths (*3*). In countries with a high perinatal burden these maternal factors account for most of the losses, but in more than half of all deaths no cause has been identified (*4*, *6*). These are exasperated by health system related factors such as lack of access to and provision of essential maternal and newborn care especially around birth and the absence of functional linkages between communities and health facilities for the provision of essential services. Inequity can occur at different levels, not only within health service delivery and at the time of utilisation but it can also exist at the community and individual level. Importantly, distal factors such as inequity in access to maternal care (*5*) have not been investigated and warrant consideration.

Though studies have analysed the relationship of birth outcomes with several biological and sociodemographic factors (*12*-*14*) there exists a gap in identifying key factors and challenges specific to individual settings in high burden countries (*3*). Women's empowerment to access healthcare services in pregnancy has not been previously considered in research originating from high burden countries. Therefore, we aimed to determine the impact of women's empowerment related factors on the risk of stillbirth and early neonatal mortality in Pakistan, specifically focusing on the role of women's empowerment to make her own decisions around pregnancy and birth and how this could impact adverse perinatal outcomes.

METHODS

We used the Pakistan DHS 2012-13 data obtained from the DHS program for the present analysis (*9*). Data from two surveys questionnaires; the women's survey and the household survey, were included in the analysis. We analysed both stillbirth and early neonatal mortality separately. We used the DHS definition of stillbirth as a ''fetal death in pregnancy lasting for seven or more months to women aged 15-49 years at the time of the survey''. The denominator for

stillbirths was pregnancies of seven or more months' duration that terminated in a fetal death plus pregnancies that ended with a live birth. Early neonatal mortality was defined as deaths between day 0 to 6 among live-born babies.

Statistical analysis and variables

Variable selection for our analysis was based on known risk factors of perinatal mortality ascertained from previous research. We classified identified variables by groups, which included sociodemographic, health services during antenatal and postnatal periods, women's empowerment and family planning use. The main exposure factors were variables that measured dimensions of women's empowerment and her access, both physical and financial, to health services, especially around the perinatal period. We categorised women who worked as either "manual work" or "no work", because most women worked in agriculture, which was a type of manual work. The household cooking fuel variable was categorised as "clean" or "unclean fuel" based on the type of the fuel the household used; kerosene was included in the unclean fuel category. For the ethnicity variable, we merged the ethnicities with very small numbers into a single category of 'others'. Women's body mass index (BMI) variable was calculated from the height and weight variables available in the data set.

Stillbirth data analysis was based on variables that measured inequities in the women's questionnaire (background characteristics, reproductive history, family planning, antenatal care, birth and postnatal care, breastfeeding and infant feeding practices etc.) and health services related variables were obtained by the household questionnaire. The stillbirth variable was generated by single STATA command that included observations for the singleton pregnancies in the last five years.

A dichotomous early neonatal mortality variable was created from a variable that initially had three categories: survived in the neonatal period, early neonatal mortality and late neonatal mortality. Observations for 'survived neonatal period' and 'late neonatal mortality' categories were merged into single category of 'no early neonatal mortality'. A framework originally developed by Mosley and Chen (*15*) to study neonatal survival was used to determine the risk factors associated with early neonatal mortality. Potential confounders were classified in groups of socioeconomic, environmental, nutrition, biological and birth spacing related factors of early neonatal mortality. Informed verbal consent was obtained from the participants in the DHS survey at the time of the interviews.

We calculated stillbirth and early neonatal mortality rates per 1000 births and live births respectively, for all variables. Descriptive data was followed by univariate logistic regression analysis reporting odds ratios and 95% confidence intervals for the two outcome variables of stillbirth and early neonatal mortality. First, groups of statistically significant (P<0.25) variables were entered the model. Next, we kept the significant variables or those known as important regardless of their statistical significance until the model was fitted. We used a backward elimination method of model building in which we included variables stepwise and group by group according to the framework above, after removing variables for multicollinearity. The variables with P>0.25 and insignificant in the univariate analysis were removed from the final multivariate models. Univariate associations of covariates with the outcome variable are presented using odds ratios (OR). In the multivariate models we adjusted for other included covariates and these are presented as adjusted odds ratios (aOR). An aOR, considers the effect of all the predictor variables included in the multivariate model and controls their confounding effect on the outcome variable. "Svy" commands were used in our analysis to adjust for the survey weights and cluster design effect of the DHS survey. Observations with missing values were excluded from the analysis. Multiple pregnancies accounted for 158 stillbirth cases and 129 in the neonatal data sets and were removed. We used STATA version 13.1 to analyse our data.

RESULTS

The analysis identified 412 (3.43%) stillbirths in 11,985 singleton births and 501 (4.25%) early neonatal deaths among 11,596 live births, in the five years preceding the DHS. In both the

neonatal and the stillbirth data sets, mothers younger than 29 years consisted of almost 50% (664) of the survey sample, about 70% (8750) belonged to rural areas, 70% (8639) used unclean fuels for cooking (and were therefore exposed to household air pollution). About 47% (5597) of the women were poor, 59% (7063) had no education and 57% (7020) of the sample were from the most populous province, Punjab. Although about three quarters (%, 9169) of women had made at least one antenatal care visit, only 14.6% (1327) had visited any health care provider during the first month of pregnancy and 51% (6125) of all births occurred in the home.

STILLBIRTHS

Overall, the stillbirth rate was 34.4 per 1000 births (Table 1). The odds of stillbirth were higher if the women belonged to Baluchi (OR=3.53, 95% CI=1.93-6.54) and Barahui (OR=3.60, 95% CI=1.46-8.92) compared to Urdu ethnicities, they lived in a rural compared to an urban area(OR=1.8, 95% CI=1.41-2.51), performed any manual work compared to no work (OR=1.60, 95% CI=1.13-2.27), their husbands were educated up to primary compared to higher education (OR=1.73, 95% CI=1.01-2.96) and were a blood relation to their husbands compared to not related to their husband (OR=1.73, 95% CI=1.23-2.43). Women's empowerment and access to health care was associated with stillbirth in the univariate analysis. Women who experienced problems compared with no problems in getting permission to attend pregnancy care (OR=1.47, 95% CI=1.08-1.99) or who had trouble getting money needed for the treatment (OR=1.49, 95% CI=1.05-2.13) and those who did not want to go alone to their health care provider (OR=1.47, 95% CI=1.08-1.99) had higher odds of stillbirth. Women who said that distance to a health facility was a big problem, compared to those who said it was not, had higher odds of stillbirth (OR=1.38, 95% CI=1.00-1.89). Women whose elders or husband decided about their healthcare compared to women who decided themselves were more than twice as likely to have a stillbirth (OR=2.24, 95% CI=1.19-4.23). Univariate analysis with family planning related variables demonstrated that women who had never used any family planning method were more likely to have had a stillbirth compared to women who had used a modern method (OR=1.61, 95% CI=1.23-2.11), women who wanted a pregnancy then compared to those who wanted no more children had a higher odds of stillbirth (OR=2.45, 95% CI=1.23-4.86). Similarly, women who believed that the ideal number of boys was more than three compared to less than three, had higher odds of stillbirth (OR=1.40, 95% CI=1.02-1.91).

Table 1. Risk factors of Stillbirths in Pakistan (2012-13)

	LIVE BIRTHS, N (%)	STILLBIRTHS, N (%)	TOTAL BIRTHS	SBR/1000 BIRTHS	OR* (95% CI)	aOR(95% CI)
Sociodemographic/community						
Age (years):						
15-24	2701 (22.8)	98 (23.8)	2799	35.0	0.98 (0.69-1.40)	0.86 [0.57-1.29)
25-29	3727 (31.4)	138 (33.4)	3865	35.6	Reference	Reference
30-34	3100 (26.1)	101 (24.5)	3201	31.6	0.88 (0.50-1.57)	0.91 (0.54-1.56)
35-49	2328 (19.6)	75 (18.2)	2403	31.2	0.87 (0.61-1.25)	0.91 (0.63-1.31)
Education:						
No education	6786 (57.2)	277 (67.3)	7063	39.2	2.09 (1.20-3.65)	
Primary	2016 (17.0)	66 (16.0)	2082	31.6	1.67 (0.88-3.18)	
Secondary	2095 (17.7)	50 (12.2)	2145	23.5	1.23 (0.64-2.38)	
Higher	959 (8.1)	19 (4.5)	978	19.2	Reference	
Ethnicity:						
Urdu	950 (8.0)	19 (4.5)	968	19.1	Reference	Reference
Punjabi	4328 (36.5)	137 (33.2)	4465	30.6	1.62 (0.94-2.81)	1.34 (0.77-2.34)
Sindhi	1168 (9.9)	46 (11.1)	1213	37.6	2.01 (1.09-3.69)	1.14 (0.59-2.20)
Pashto	1563 (13.2)	49 (12.0)	1612	30.6	1.62 (0.89-2.96)	1.32 (0.70-2.46)
Baluchi	584 (4.9)	40 (9.8)	625	64.4	3.53 (1.93-6.45)	1.93 (1.03-3.61)
Barahui	340 (2.9)	24 (5.8)	364	65.6	3.60 (1.46-8.92)	2.25 (0.85-5.98)
Siraiki	1980 (16.7)	79 (19.3)	2060	38.5	2.06 (1.05-4.01)	1.46 (0.72-2.94)
Others	934 (7.9)	18 (4.4)	952	19.0	1.00 (0.44-2.26)	0.82 (0.36-1.87)

Table 1. Continued

	LIVE BIRTHS, N (%)	STILLBIRTHS, N (%)	TOTAL BIRTHS	SBR/1000 BIRTHS	OR* (95% CI)	aOR(95% CI)
Place of residence:						
Urban	3444 (29.1)	74 (17.9)	3518	21.0	Reference	
Rural	8412 (70.9)	338 (82.1)	8750	38.7	1.88 (1.41-2.51)	
Women's occupation:						
No work	8770 (74.2)	264 (64.2)	9034	29.2	Reference	Reference
Manual work	3056 (25.8)	147 (35.8)	3203	45.9	1.60 (1.13-2.27)	1.55 (1.09-2.21)
Husband's education:						
No education	4031 (34.1)	146 (35.4)	4177	34.9	1.49 (0.93-2.37)	
Primary	2029 (17.2)	85 (20.7)	2114	40.4	1.73 (1.01-2.96)	
Secondary	3967 (33.5)	137 (33.2)	4104	33.3	1.42 (0.87-2.30)	
Higher	1798 (15.2)	44 (10.6)	1842	23.8	Reference	
Blood relation with husband:						
No	4026 (34.0)	95 (23.0)	4121	22.9	Reference	Reference
Yes	7827 (66.0)	317 (77.0)	8144	39.0	1.73 (1.23-2.43)	1.45 (1.01-2.06)
Husband related as:						
1st cousin on father's side	3275 (41.9)	165 (52.3)	3440	47.9	1.87 (1.05-3.35)	
1st cousin on mother's side	2463 (31.5)	94 (29.9)	2557	36.9	1.42 (0.72-2.81)	
Second cousin	949 (12.1)	25 (8.1)	975	26.1	1.00 (0.47-2.12)	
Other/not related	1133 (14.5)	31 (9.7)	1164	26.2	Reference	
Getting medical help for self: (maternal healthcare access):						
Getting permission to go:						
Big problem	2541 (21.5)	118 (28.6)	2659	44.4	1.47 (1.08-1.99)	
Not a big problem	9294 (78.5)	294 (71.4)	9588	30.7	Reference	
Getting money needed for treatment:						
Big problem	3965 (33.5)	177 (43.0)	4142	42.7	1.49 (1.05-2.13)	
Not a big problem	7870 (66.5)	235 (57.0)	8105	29.0	Reference	
Distance to health facility:y						
Big problem	4850 (41.0)	201 (48.9)	5051	39.8	1.38 (1.00-1.89)	
Not a big problem	6985 (59.0)	211 (51.1)	7196	29.3	Reference	
Not wanting to go alone:						
Big problem	7039 (59.5)	281 (68.3)	7320	38.4	1.47 (1.08-1.99)	
Not a big problem	4797 (40.5)	131 (31.7)	4928	26.5	Reference	
Usually deciding respondent's healthcare:						
Respondent alone	1005 (8.6)	21 (5.2)	1026	20.5	Reference	Reference
Respondent and husband/partner	4478 (38.2)	125 (31.0)	4603	27.1	1.33 (0.70-2.52)	1.23 (0.64-2.35)
Husband/partner alone	4016 (34.3)	153 (38.0)	4169	36.7	1.82 (0.93-3.55)	1.51 (0.77-2.98)
Family elders/others	2213 (18.9)	104 (38.0)	2317	44.8	2.24 (1.19-4.23)	2.04 (1.05-3.99)
Beating justified if wife argues with husband:						
No	7902 (66.8)	249 (60.5)	8151	30.6	Reference	
Yes	3747 (31.7)	157 (38.2)	3904	40.3	1.57 (1.08-2.28)	
Don't know	183 (1.5)	5 (1.3)	188	28.1	0.66 (0.15-2.85)	
Birth and family planning:						
Ever used any family planning method:						
Used modern	6206 (52.3)	178 (43.1)	6384	27.8	Reference	Reference
Never used any	4713 (39.7)	217 (52.7)	4930	44.0	1.61 (1.23-2.11)	1.47 (1.06-2.04)
Used only traditional	938 (7.9)	17 (4.1)	955	17.9	0.66 (0.36-1.20)	0.67 (0.36-1.23)
Last pregnancy wanted:						
No more	1121 (9.5)	13 (4.4)	1134	11.2	Reference	
Then	9295 (78.5)	257 (89.3)	9552	26.9	2.45 (1.23-4.86)	
Later	1418 (12.0)	18 (6.3)	1436	12.6	1.12 (0.45-2.82)	
Ideal number of boys:						
0-2 boys	8239 (69.5)	255 (62.0)	8494	30.1	Reference	
≥3 boys	3618 (30.5)	157 (38.0)	3774	41.5	1.40 (1.02-1.91)	

SBR – stillbirth rate, OR – odds ratio, CI – confidence interval
*Crude.
†Adjusted for age, ethnicity, respondent's occupation, decision about health care and ever use of a family planning method.

In the final multivariate model, ethnicity was statistically associated with stillbirth and being Baluchi compared to Urdu carried almost a twofold risk of stillbirth (aOR=1.93, 95% CI=1.03-3.61). Women who reported manual labour had 1.55 times higher odds of stillbirth compared to women who did not work (aOR=1.55, 95% CI=1.09-2.21). Women with a blood relationship to their husbands had 1.45 times higher odds of stillbirth compared to women who were married to a non-blood related husband (aOR=1.45, 95% CI=1.01-2.06). Women whose family elders decided about their healthcare compared to women who decided themselves were twice at risk of stillbirth (aOR=2.04, 95% CI=1.05-3.99). Women who had never used any (traditional or modern) method of family planning were 1.47 times more likely to have had a stillbirth compared to women who had ever used a modern method (aOR 1.47, 95% CI=1.06-2.04). The stillbirth model included the education variable however it was not statistically significant in the multivariate model. Similarly, as age is associated with stillbirth we made an a priori decision to retain maternal age variable in the stillbirth model.

EARLY NEONATAL MORTALITY

Overall, the early neonatal mortality rate was 43 per 1000 live births (Table 2). Women with no education compared to higher education (OR=2.66, 95% CI=1.42-4.99) and Baluchi compared to Urdu ethnic women (OR=2.33, 95% CI=1.32-4.09) were more than twice as likely to have had an early neonatal mortality. Women who lived in a rural compared to an urban area (OR=1.72, 95% CI=1.28-2.31) and women who did manual work compared to no work were also more likely to have had an early neonatal mortality (OR=1.41, 95% CI=1.13-1.96). The association between women's empowerment and health care access with early neonatal mortality showed that women who reported that it was a "big problem" in getting money for treatment (OR=1.39, 95% CI=1.05-1.83) and women who did not want to go alone for pregnancy care had higher odds of early neonatal morality (OR=1.39, 95% CI=1.04-1.84). Newborns whose birth weight was unmeasured compared to those with birth weight of >2500 g had

Table 2. Risk factors of early neonatal mortality in Pakistan (2012-13)

	SURVIVED EARLY NEONATAL PERIOD, N (%)	EARLY NEONATAL MORTALITY, (%)	TOTAL	EARLY NEONATAL MORTALITY RATE/1000 LIVE BIRTHS	OR* (95% CI)	aOR(95% CI)
Sociodemographic/community						
Age (years):						
25-29	3616 (32.0)	109 (21.7)	3725	29.2	0.65 (0.41-1.02)	
30-34	2922 (25.9)	140 (27.8)	3062	45.6	1.03 (0.68-1.56)	
35-49	2180 (19.3)	133 (26.6)	2313	57.6	1.32 (0.95-1.82)	
Education level:						
No education	6439 (57.0)	331 (66.0)	6770	48.9	2.66 (1.42-4.99)	
Primary	1915 (16.9)	82 (16.4)	1997	41.2	2.23 (1.10-4.52)	
Secondary	2012 (17.8)	70 (14.0)	2083	33.7	1.81 (0.90-3.64)	
Higher	934 (8.3)	18 (3.6)	952	18.9	Reference	
Ethnicity:						
Urdu	908 (8.0)	36 (7.2)	944	37.7	Reference	
Punjabi	4143 (36.7)	158 (31.9)	4301	36.8	0.98 (0.58-1.63)	
Sindhi	1096 (9.7)	63 (12.6)	1159	54.2	1.46 (0.84-2.55)	
Pushto	1517 (13.4)	42 (8.4)	1559	26.7	0.7 (0.4-1.23)	
Baluchi	536 (4.7)	49 (9.8)	585	83.5	2.33 (1.32-4.09)	
Barauhi	331 (2.9)	19 (3.7)	349	53.0	1.43 (0.87-2.36)	
Siraiki	1879 (16.6)	89 (18.0)	1968	45.3	1.21 (0.68-2.17)	
Others	886 (7.8)	42 (8.4)	928	44.8	1.2 (0.69-2.09)	
Place of residence:						
Urban	3316 (29.3)	101(20.2)	3417	29.6	Reference	
Rural	7984 (70.7)	400 (79.8)	8384	47.7	1.72 (1.28-2.31)	
Respondent's occupation:						
No work	8391 (74.5)	332 (66.2)	8723	38.1	Reference	
Manual work	2878 (25.5)	169 (33.8)	3047	55.6	1.49 (1.13-1.96)	

	SURVIVED EARLY NEONATAL PERIOD, N (%)	EARLY NEONATAL MORTALITY, (%)	TOTAL	EARLY NEONATAL MORTALITY RATE/1000 LIVE BIRTHS	OR* (95% CI)	aOR(95% CI)
Health care access:						
Getting medical help for self: getting money needed for treatment:						
Big problem	3759 (33.3)	205 (41.0)	3964	51.8	1.39 (1.05-1.83)	1.67 (1.06-2.63)
Not a big problem	7521 (66.7)	296 (59.0)	7817	37.9	Reference	Reference
Getting medical help for self: not wanting to go alone:						
Big problem	6677 (59.2)	335 (66.8)	7011	47.8	1.39 (1.04-1.84)	
Not a big problem	4604 (40.8)	167 (33.2)	4770	34.9	Reference	
Child and maternal nutrition:						
Birth weight:‡						
>2500 g	1060 (9.5)	15 (3.0)	1075	14.0	Reference	Reference
<2500 g	340 (3.0)	9 (1.9)	350	26.6	1.9 (0.68-6.74)	2.44 (0.25-23.68)
Not weighed	8301 (74.0)	419 (84.7)	8719	48.0	3.6 (1.77-7.14)	4.39 (1.00-19.33)
Don't remember	1510 (13.5)	51 (10.4)	1561	32.9	2.4 (1.09-5.31)	2.17 (0.42-11.35)
Body mass index of mother:						
≤18.5	569 (14.2)	46 (24.5)	615	74.7	1.68 (1.05-2.69)	1.61 (1.00-2.58)
18.5-24.9 (ref)	2155 (53.7)	104 (55.2)	2259	45.8	Reference	Reference
25.0–29.9	829 (20.7)	27 (14.5)	856	31.8	0.68 (0.32-1.48)	0.74 (0.35-1.57)
≥30.0	458 (11.4)	11 (5.8)	469	23.2	0.50 (0.22-1.12)	0.65 (0.28-1.52)
Maternal factors and family planning:						
Wanted last child:						
Wanted no more	1063 (9.4)	50 (10.1)	1113	44.9	Reference	Reference
Wanted then	8830 (78.4)	417 (84.1)	9246	45.1	1.00 (0.64-1.57)	0.78 (0.37-1.66)
Wanted later	1376 (12.2)	29 (5.9)	1405	20.7	0.45 (0.23-0.89)	0.17 (0.05-0.59)
Total pregnancy outcomes:						
1-2	3073 (27.2)	101 (20.2)	3174	31.9	Reference	
3-4	3683 (32.6)	158 (31.5)	3841	41.1	1.30 (0.85-1.98)	
>5	4544 (40.2)	242 (48.3)	4786	50.6	1.62 (1.14-2.29)	
Current use by method type:						
Modern method	3126 (27.7)	98 (19.6)	3225	30.4	Reference	
No method	6978 (61.8)	371 (74.1)	7350	50.5	1.70 (1.22-2.36)	
Traditional method	1195 (10.6)	32 (6.4)	1227	26.0	0.86 (0.46-1.63)	

OR – odds ratio, CI – confidence interval
*Crude.
†Adjusted for: Getting medical help for self: getting money needed for treatment, birth weight, respondent's BMI and desire for last child.
‡Birth weight: 2500 g is classified as normal, <2500 g low birth weight.

very high odds of death within the first week of life (OR=3.6, 95% CI=1.77-7.14). Also, mothers with BMI of <18.5kg/m^2 compared to mothers within normal BMI had higher odds of an early neonatal mortality (OR= 1.68, 95% CI=1.05-2.69). Family planning also had a similar pattern of association to the stillbirth results. Women who wanted their last child later compared to those who did not want any child had almost 50% reduced odds of an early neonatal mortality (OR=0.45, 95% CI=0.23-0.89). Higher gravida of >5 pregnancies compared to 1-2 pregnancies carried a higher likelihood of early neonatal mortality (OR=1.62, 95% CI=1.14-2.29). Non-use of family planning methods compared with the use of a modern method carried a 70% higher risk of early neonatal mortality (OR=1.70, 95% CI=1.22-2.36).

The final adjusted multivariate model for the early neonatal analysis was explained mainly by variables related to mothers facing problems in financial access to receiving treatment during pregnancy and birth (aOR=1.67, 95% CI=1.06-2.63), babies not weighed at birth (aOR=4.39, 95% CI=1.00-19.33) and malnourished mothers with a BMI <18.5 (aOR=1.61, 95% CI=1.00-2.58). Mothers who wanted their last child later than when the child was born compared to mothers who wanted no more children were at a lower risk of early neonatal mortality (aOR=0.17, 95% CI=0.05-0.59). Variables such as antenatal care or place of birth did not show any statistically significant association with any of the two outcomes in our univariate analysis.

DISCUSSION

We identified that maternal empowerment and health care access related factors were strong predictors of both stillbirth and early neonatal mortality in Pakistan. Our multivariate analysis identified two important and direct predictors of women's empowerment with the both stillbirth and early neonatal mortality. Mothers whose family elders decided their healthcare were twice more likely to have had a stillbirth and mothers facing 'big' problems in financial access to receiving pregnancy care were 1.67 times more likely to have experienced an early neonatal mortality.

Women's empowerment is a multifaceted concept and has both important cultural and individual versus population level differences. Using the 2011-2012 Pakistan DHS data we had access to some variables that would capture women's individual empowerment. In a study from Pakistan, economic stability, social acceptability, educational achievement, and family harmony was defined as women's empowerment and certainly the variables that we used in our analysis aligned with this concept (*16*). Mothers' lack of decision-making ability and financial access to health care and therefore, her lack of empowerment during pregnancy care showed a strong association with the two outcomes of perinatal mortality in our study. Maternal empowerment has been shown to be related to a lack of polio vaccination for children in Pakistani children (*17*). In the Pakistani culture, cultural beliefs and practices, gender discrimination and lack of women's autonomy are important factors determining their health seeking behaviour for themselves and their children. Women in poor and disadvantaged communities are at increased risk of diminished autonomy and therefore lack access to essential health care for themselves and their children, especially around pregnancy and birth. Decisions about health care utilisation are often taken by the household elders, usually the males, rendering these women disempowered and exposing them to higher risks of complications leading to worse outcomes during pregnancy and birth (*18*). Previous studies have highlighted the importance of integrating health services and engagement with communities and thereby empowering the community groups, for instance, to improve the quality of healthcare services offered to women and children to reduce neonatal mortality (*19*). The health system bottlenecks related to governance, financing and service delivery and lack of engagement with local communities to improve their access to healthcare is related with poor maternal and child health outcomes (*20*). In similar settings, these bottlenecks have been successfully overcome by packaging prevention interventions through elimination of financial and cultural barriers to healthcare access for vulnerable and culturally disengaged communities (*21*). Health system interventions for perinatal mortality prevention need to be implemented keeping the cultural context in perspective so that vulnerable women are effectively linked with quality health services at all stages of pregnancy, labour and birth (*22*). Additionally, improving women's education and hence empowerment is essential to improve existing health seeking practices often shown to be associated with child morbidity and mortality in Pakistan (*23*).

Other important variables we identified as surrogate indicators of women's empowerment included; doing manual labour, consanguinity and family planning practices. Women doing manual work compared with no work had higher odds of perinatal mortality in our study. Since 70% of the sample comprised of rural women, the most common manual work that they performed was related to agriculture. We found that such work was associated with 1.55 times higher odds of stillbirths in women. Whether these women continue to work while pregnant and what they do if a complication requires them to rest warrants further research. Nevertheless previous research clearly shows that working in agriculture increases pregnant women's exposure to heavy lifting and to pesticides which is associated with adverse outcomes of low birth weight, small for gestational age babies and other complications during pregnancy (*24*-*26*). Another surrogate of women's empowerment was being related to her husband which increased the risk of stillbirth by 1.45-fold. Apart from the biological aspect of consanguineous marriages and their relation with adverse child health outcomes (*27*), this highlights that women in rural communities lack autonomy and authority for making decisions

to choose life partners and are often married against their will at very young ages mostly to their paternal or maternal cousins (*28*). Similarly women's contraceptive empowerment is closely linked with their planning, and decision making about access to and use of modern contraceptives giving long-term protection from pregnancy (*29*). In rural Pakistani culture it is the husbands or the elderly members in families who decide about the use of contraception and the number of children (*18*). Stillbirth was associated with wanting child 'then' compared with wanting no more in the univariate analysis and wanting to have a pregnancy may not mean planning a pregnancy. It may mean that women allow the pregnancy to happen rather than plan for it and most likely it is due to the lack of any intention to use contraception.

Living in rural areas, being socioeconomically disadvantaged and having no or low education showed statistically significant associations with both perinatal outcomes and are additional proxy indicators of women's lack of empowerment to access health care during pregnancy and birth. In the final stillbirth model, women's ethnicity was statistically significant with stillbirth and belonging to a Baluchi ethnicity carried almost a twofold risk of stillbirth. Baluchi is spoken by most of the population in Baluchistan where maternal and child health, as well as other socioeconomic indicators are historically poorest compared to the rest of the country because of poor development, conflict and health system factors (*30*).

Mothers with low birth weight newborns or those not weighed at birth and malnourished mothers had very high odds of early neonatal mortality. These results reassert the association of maternal and fetal malnutrition with perinatal mortality (*31*). The finding that early neonatal mortality risk was higher among newborns not weighted at the time of birth could be explained by home birth without a skilled birth attendant at the time of birth. Our final model for early neonatal mortality emphasises the significance of maternal nutritional status and its association with perinatal mortality (*31*). This also demonstrates that the progress made towards improving maternal nutrition in Pakistan is dismal, and programs especially national maternal and child nutrition programs, must reassess their strategies to reduce the burden of malnutrition in mothers and children.

Strengths and weaknesses

Women's empowerment gives an innovative perspective to the understanding of complex sociocultural and biological factors of perinatal mortality in a high perinatal burden context of Pakistan. Analysis of the large nationally representative sample and adjustment for cluster sampling effect and confounding factors were strengths of the study. We used data only from the last five years to minimise recall bias. We removed cases of multiple pregnancies from our analysis because multiple pregnancies are known biological risks of perinatal mortality. However, this study has some limitations. Underestimation of stillbirths and early neonatal deaths could be a possibility in our study because of diverse reasons for instance, some geographic areas were omitted from data collection in the DHS survey because of conflict and these areas could possibly have worse perinatal outcomes. There may be a possibility of misclassification bias, whereby a stillbirth was classified as an early neonatal death.

Implications

Patriarchal decision-making is highly entrenched in the cultural norms of Pakistani communities especially in rural areas where women are not supported to make their own and their children's health care decisions, which affects women's and children's health and survival during and after birth. An understanding of the local culture and women's empowerment in accessing health care around pregnancy and birth and even during recuperation from a previous pregnancy, is important for identification of risk factors of perinatal mortality. Our analysis also highlights the need and importance of the relevant local data on perinatal mortality outcomes including identification and estimation of individual and complex risk factors during the critical perinatal period. Usefulness of these data cannot be underestimated in the development and implementation of maternal and child survival programs and strategies.

CONCLUSION AND RECOMMENDATIONS

In conclusion, this study found that the mothers who considered it a "big problem" to decide about their treatment and could not financially access the health care during pregnancy and birth had higher likelihood of experiencing perinatal mortality. Women's empowerment needs to be further studied to ascertain the mechanisms by which it leads to higher risk of perinatal deaths in developing countries. Women's empowerment also needs to be incorporated within the perinatal mortality prevention implementation strategies. More information in DHS surveys about access to and quality of care, especially advanced care, during maternal and newborn complications would improve our understanding of health service related factors of perinatal deaths.

Funding: JA is supported by the Research and Training Program of The University of Sydney Strategic Fund and CRG is supported by the National Health and Medical Research Council (of Australia), Career Development Fellowship 1087062.

Authorship contributions: JA and CRG conceived the study. JA conducted the analysis and prepared the manuscript. CRG advised on data analysis and revised the manuscript. AA revised the manuscript. All the authors approved the manuscript.

Competing interests: The authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare no conflict of interest.

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