Determinants of maternal mortality in districts Jhang and Khanewal

Muhammad Sulaman Ijaz[1], Saana Bibi[2], Asad Elhai[3]
[1]Research Coordinator, Rural Support Programme Network, Islamabad. Pakistan
[2]Bio Statistician, Director Research & Monitoring at Ministry PASS, Islamabad Pakistan
[3]PhD candidate, Department of Statistics, Quaid I Azam University, Islamabad
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Abstract

According to the WHO calculations, approximately 295000 women died globally in 2017 from maternal health causes, with which 94% of all maternal deaths occur in low and lower-middle-income countries. Among those countries India, Nigeria, and Pakistan are at the top of the list in maternal and neonatal deaths. The study determines the risk factors associated with maternal and neonatal health during pregnancy, which helps provide a better understanding to generate preventive measures to reduce the high rates of maternal mortality. For this purpose, data from the recently established maternal, newborn, and child health program in two Districts in Pakistan was used for the analysis. We used multinomial logistic regression to model the risk factors associated with maternal and neonatal health during pregnancy, such as swelling of feet, Anemia, fetal movements, vaginal bleeding, and white vaginal discharge in the last three months of pregnancy. Categorical Principal Component Analysis (CATPCA) was used to determine the optimal combinations that best explain the non-normalcy of the observed data. Results from CATPCA showed that 17 parameters in the model explained 96.6% variation of the data. Compared to the multinomial logit model, CATPCA provides a more transparent and precise picture of the risk factor associated with the health of pregnant women.

Keywords:*, Child Health Program, Maternal Mortality, Maternal Health, Newborn.*

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Correspondence:
Muhammad Sulaman Ijaz
Email: slmanijaz@gmail.com

Introduction

The Maternal Mortality rate in the world is significantly increasing over time, especially in developing countries. Therefore, worldwide organizations have been focused considerably on reducing maternal mortalities by introducing multiple programs over the past few decades. In Pakistan, the child death rate is 66 for every 1000 live births; infant mortality is 55 deaths per 1000 live births. The maternal mortality ratio (MMR) is 157 per 100,000 live births in Punjab. The ratio is 26% higher in ruler areas compared to Pakistan's urban areas. According to the latest Pakistan mortality survey (PMMS) analysis, the maternal mortality proportion is 186 deaths per 100,000 live births in Pakistan. Due to pregnancy-related complications, every year, about 30000 women die. In September 2000, Pakistan and other nations acknowledged the United Nations Millennium Declaration in which the objectives included decreasing neonatal mortality and reducing 75% maternal mortality proportion from 1990 to 2015 (Mehboob, R. et al., 2020). Still, maternal health has gained first ranking in the 3rd Sustainable Development Goal due to its severity, targeting reducing maternal mortality to below 70 per one lac live births by 2030.

Even though there have been substantial developments in the health care system, Pakistan still faces numerous challenges to its extreme population increase, maternal and infant mortality, and many non-infectious and infectious diseases. Pakistan has poor performance in the development indicator regarding maternal health care (Omer S. et al., 2021). As women in less developed countries have more pregnancies, their lives are at high risk compared to those of developed countries. Antenatal care (ANC) is one of the components of care to be provided to pregnant women. Receipt of regular antenatal care (ANC) is a robust tool for reducing maternal mortality (Gillani, S. et al., 2021). ANC refers to the standard medical and nursing care advised for women during pregnancy to prevent, detect and treat complications. Early initiation of ANC is an opportunity to prevent the direct sources of maternal deaths and plays a significant role in reducing neonatal and fetal deaths associated with obstetric complications (Yeneneh, A., et al., 2018). Antenatal care (ANC) plays a major role in minimizing maternal and child mortality through effective and appropriate screening, preventive, or treatment intervention. Women who were the richest were more likely to utilize ANC than the poorest women. This is because women in better socioeconomic status can pay for both direct and indirect healthcare costs (Kuhnt J. et al., 2017; Yeneneh, A., et al., 2018). A recent study revealed that the higher education level of the woman was a significant factor in determining optimal ANC utilization. This might be because the educated women most likely have adequate knowledge of ANC services and understand the importance of early booking for ANC and attending the recommended four visits. In addition, women with better educational status can identify danger signs and easily understand the adverse outcome of avoiding the recommended ANC service (Raru, T. B. et al., 2022). A study conducted in Pakistan also found that women from higher socioeconomic status and higher educational attainment were more likely to receive ANC (Abdul Ghaffar et al., 2015).

According to Sanni Yaya et al. (2018), a reduction in maternal mortality could be achieved by increasing educational attainment among women, providing universal healthcare access to maternal services, and having deliveries performed by skilled birth attendants. Over the previous three decades, significant changes occurred in the health quality of brazil and influenced maternal

mortality. It was found that improvement in women's education levels, reduction in poverty, urbanization, and improved water and sanitation were the main factors associated with reducing maternal mortality (Leal, M. D. C., et al., 2018). The experience, expectations, and social support influence the recognized quality of Maternal health care. Social engagements could be considered as a source of information on the facility, and details of the health care system and can change the demand for services by affecting the perceived merit of the available services. Therefore, women who have social engagements and support from their families were more likely to receive ANC services than women without any social engagement and support (Hagaman, A., et al., 2022; Demissie, A., 2022).

The adequate ANC is significantly dependent on the timely initiation of the first visit and quality care to migrate risk factors in pregnancy. Obstetric pregnancy danger signs familiarities, including decision making on health care seeking and giving birth are pivotal determinants of adolescent mothers' timing of the first ANC visit and uptake of the recommended components of care. Ensuring accessibility and affordability of these services among health facilities will significantly increase the uptake and early timing of the antenatal care services among adolescent mothers in rural communities (Kayemba, V. Et al., 2022). Since ANC is an essential tool for reducing maternal mortality, barriers to access to these services should be reduced. Khanal, M., & Khanal, R. (2021) found that physical distance to a health facility in Kenya, lack of transportation, and economic consideration were important factors associated with maternal health services. Other factors associated with lower access to ANC services include women with unintended pregnancies since they have been found to have a higher hesitancy to access these services due to societal stigma (Ahinkorah, B. O., 2020).

Pakistan still faces difficulties regarding the well-being framework. The fundamental goal of maternal, newborn, and child health (MNCH) started by the Pakistan government was the reduction of maternal and neonatal deaths by 2015. Five years later, Pakistan has still not achieved its MNCH goals. National for primary health care and family planning in Punjab has approximately 48,000 trained Lady Health Workers (LHW), providing preventive and social insurance in their assigned areas and are identified as the provider of community-based services and gatekeepers for safe child birthing services. Despite these measures, there are still high maternal mortality rates in Punjab. Therefore, this study aims to determine the risk factors associated with maternal and neonatal health during pregnancy.

Methodology:

Study Design and Area

This study has taken data from secondary sources that are part of a national maternal newborn and child health (MNCH) program. The Legislatures of Pakistan initiated it to address administrative accessibility and care services usage. A cluster randomized controlled trial (cRCT) design was conducted from February 2011 to June 2014. The cluster randomization was considered three treatments focused at the community level. The first treatment group (TG1) included birth plans, preparedness, and financial facilities for the females surveyed. Only birth preparedness was provided in the second treatment group (TG2). The third

treatment group (TG3) was the control group, where women were only observed under the present circumstances. All primary health centers in Pakistan were considered. Twenty-six clusters of primary health centers in districts Jhang and Khanewal of Punjab, Pakistan, were chosen for the study population. In the study sample, 21 clusters of enabled health facilities were considered. A total of 58,870 females were included in the sample taken from the two Districts with cluster size=7 in each treatment group. A detailed description of variables utilized in the analysis is provided in supplementary file. The statistical analysis is performed using *SPSS. Version* – 20, Released (2011) to fulfill the study's objectives.

Data Modeling

The response variable has three treatment groups of nominal scale with mixed; quantitative & categorical explanatory variables. Table.1 shows the description and measurement of the parameters of MNCH data. Categorical Principal Component Analysis is performed (CATPCA) to identify the factors affecting skilled maternal care in the two Districts. It decreases the dimensionality of huge and complex data sets into a few latent variables. Furthermore, it provides an arrangement of variables representing a significant part of the variety as conceivable. The essential advantage of utilizing CATPCA in our data is that technique does not require data linearity, Lu et al. (2014). The presumption for the data using the principal categorical component is that the probability of the data X follows an exponential family distribution.

$P(x|\vartheta) = \exp(X\vartheta + \log p0(X) - H(\vartheta))$

Here X is the ith data point, ϑ is the natural parameter, p0 can be considered a constant term, so ignored here, and $H(\vartheta)$ is the corresponding distribution. For continuous data, $H(\vartheta) = \vartheta^2/2$, and for multinomial data,

$H(\vartheta)=\log \sum_{m=1}^{k} \exp(\vartheta^m)$, ϑ^m is a canonical parameter corresponding to X^m. Canonical parameter analogous to the subject in CPCA constitutes as $\vartheta_i^m = R^m G_i + \mu^m$. Where R is the loading matrix and G is the principal component scores for that matrix. The conditional log-likelihood function of the n point, w.r.t their principal components, can be written as,

$L = \sum_{i=1}^{n} (\vartheta i^m Xi - H(\vartheta))$

By maximizing the log-likelihood function L, the principal component score matrix G can be estimated.

Multinomial logistic regression explains the factors that affect pregnant women's health and problems in approaching maternal care & skill birth attendance during the gestational period. Multinomial logistic regression estimates categorical and independent study variables, either dichotomous (binary) or continuous. It does not require normality, linearity, and homoscedasticity. Standard logistic regression has a linear model for one response function, whereas multinomial logit models for a response variable with c classifications have c1 response functions. These functions have a linear model for each one; It's like multivariate regression. Suppose Y takes values y1, y2, ..., ym on a nominal scale, then the multinomial logit model form categories are needed m – 1 generalized logit to represent a dependent variable with m categories. The general solution probability for each outcome is,

$$y_1 = \frac{e^{L_1}}{1+\sum_{j=1}^{m-1} e^{L_j}} \quad , j = 1, 2 \ldots m-1$$

$$y_2 = \frac{e^{L_2}}{1+\sum_{j=1}^{m-1} e^{L_j}}$$

$$\vdots$$

$$y_{m-1} = e^{L_{m-1}} \quad 1 + \sum_{j=1}^{m-1} e^{L_j}$$

$$y_m = \frac{1}{1+\sum_{j=1}^{m-1} e^{L_j}}$$

A positive regression coefficient for logit j means that higher values of the independent variable are associated with greater chances of response category j than the reference category. The multinomial logit model employs a relative risk ratio rather than odd ratios as simple logistic regression. The reason is that the binary logistic regression model assumed values 1 and 0 are not independent. If 1 is coded for the success, then 0 is coded for the failure; thus, it makes sense to use odd ratios, but in multinomial logistic regression, categories are independent of each other.

Results

CATPCA for the predictor/parameters is calculated by specifying the two dimensions. The analysis is done by using SPSS software. The correlation matrix of the parameters and individual variance accounted for each parameter in 2 dimensions are estimated. The correlation in CATPCA-1 account using all explanatory variables (Cronbach's Alpha) shows that dimension1 account the 31% variance while dimension 2 accounts for 20.1%. The total model (both dimensions) accounts 51.2% of the variance in the optimally scaled variables, which is quite low. Coordinates of each parameter on each dimension tie into the centroid (0,0) and display a very small mean coordinate, demonstrating that parameters do not contribute significantly to the principal components. In CATPCA-1 Mother age (MA), mothers' height (MH), mother weight (MW), history of c-section (HOC), antenatal visits during six months of pregnancy (NU6), type of skilled birth attend (TPA), mode of the delivery (MOD) and few other parameters are near or underneath 0.01 (Table-1). Above mention parameters' participation may not be suitable for the principal components Running in CATPCA-2 where parameters TND, TNCA, MA, MH, MW, CHD, MEDU, HOA, HOC, NU6, TPA, and PDU are evacuated. Calculation shows that 53% of the change is represented by dimension1, 43.6% of the fluctuation is represented by dimension2, and 96.6% of the fluctuation is represented in 17 parameters of the aggregate model (both dimensions). This contrasts well because, with the fewer parameters, more of the variance accounted (96.6%) as compared to the model, which used all the 31 parameters and explained 52.1% variation of the total variance (Table-2).

Table 1: Frequency N(%) of women by background characteristics examines by LHW, 2015 MNCH (Jhang and Khanewal)

Characteristics		TG1	TG2	Control
Mother Age	<18years	287.3(31.1%)	259(36.2%)	254.7(32.7%)
	18-35year	17768.2(35.8%)	16018.5(31.8%)	15756.3(32.3%)
	>35year	2448.1(32.3%)	2207.0(38.6%)	2170.9(29.2%)
Mother Height	>4.8 inch	9181.2(23.9%)	8277.1(33.6%)	8141.7(42.5%)
	<4.8 inch	inch 2548.9(26.2%)	2297.9(27.7%)	2260.3(46.1%)
Mother Weight	<45 kg	939.3(27.1%)	846.8(23.9%)	832.9(48.9%)
	45-80 kg	11931.6(26.3%)	10756.7(41.5%)	10580.7(32.3%)
	>80 kg	396.3(36.7%)	357.3(19.4%)	351.4(44.0%)
Total number of deliveries	1-4	17742.0(36.4%)	16521.3(34.5%)	14695.7(29.1%)
	5-8	1822.8(35.0%)	1697.4(26.7%)	1509.8(38.3%)
	9-12	56.2(29.7%)	52.3(18.7%)	46.5(51.6%)
Any chronic disease	Yes	525.8(31.2%)	474(49.2%)	466.2(19.6%)
	No	18793.2(32.6%)	16942.6(34.2%)	16665.3(33.2%)
Any medicine being used by mother	Yes	958.6(25.9%)	864.2(27.5%)	850.1(46.6%)
	No	No 18182.4(32.6%)	16391.9(35.3%)	16123.7(32.1%)
History of abortion	Yes	676.4(32.0%)	609.8(32.8%)	599.8(35.2%)
	No	19377.8(33.3%)	17469.6(33.8%)	17183.7(32.8%)
Number of LHW antenatal exams during 1st and 2nd trimesters	1	11164.9(36.0%)	10065.4(29.2%)	9900.7(34.8%)
	2	1725.4(36.5%)	1555.5(43.2%)	1530.1(20.3%)
	3	2299.6(38.4%)	2073.2(42.9%)	2039.2(18.7%)
	4	3461.2(39.3%)	3120.4(28.2%)	3069.3(32.5%)
Number of LHW antenatal exams during 3rd trimesters	1	3958(46.0%)	3568.2(33.6%)	3509.8(20.4%)
	2	3377(45.4%)	3044.4(31.8%)	2994.6(22.7%)
	3	3996.3(39.7%)	3602.8(30.1%)	3543.8(30.1%)
Anemia during 6 months of pregnancy	Yes	Yes 2112.8(27.3%)	1904.7(31.8%)	1873.5(40.8%)
	No	No 15560.7(36.2%)	14028.4(33.4%)	13798.8(30.3%)
Anemia during 3rd trimester of pregnancy	Yes	2306.4(44.7%)	2079.3(25.4%)	2045.3(29.9%)
	No	8749.4(44.1%)	7887.8(34.2%)	7758.7(21.7%)
Swelling of feet during 6 months of pregnancy	Yes	1486.9(31.4%)	1340.5(35.4%)	1318.6(33.2%)
	No	16132.8(35.6%)	14544.1(33.1%)	14306.1(31.3%)
Swelling of feet during 3rd trimester of pregnancy	Yes	1623.6(31.9%)	1463.7(34.4%)	1439.7(33.7%)
	No	9385.3(46.6%)	8461.1(32.2%)	8322.6(21.2%)
Last recording of fetal movement during 6 months of pregnancy	Yes	16304.9(35.1%)	14699.3(32.6%)	14458.8(32.3%)
	No	1331.3(35.9%)	1200.2(41.4%)	1180.5(22.7%)
Last recording of fetal movement during 3rd trimester of pregnancy	Yes	10235.6(44.5%)	9227.7(31.5%)	9076.7(24.0%)
	No	988.1(36.0%)	890.8(37.2%)	876.2(26.7%)
Vaginal bleeding during 6 months of pregnancy	Yes	847.8(34.7%)	764.3(44.5%)	751.8(20.8%)
	No	16775.1(35.2%)	15123.2(32.7%)	14875.7(32.1%)
Vaginal bleeding during 3rd trimesters of pregnancy	Yes	846.4(36.7%)	763(41.3%)	750.6(22.0%)
	No	0156.7(45.1%)	9156.6(31.8%)	9006.7(23.1%)
Foul smelling vaginal discharge during 6 months of pregnancy	Yes	747.4(31.8%)	673.8(46.2%)	662.8(22.0%)
	No	16870.5(35.4%)	15209.2(32.7%)	14960.3(32.0%)
Foul smelling vaginal discharge during 3 trimesters of pregnancy	Yes	775.7(35.3%)	699.4(41.2%)	687.9(23.5%)
	No	10228.5(45.2%)	9221.2(31.8%)	9070.3(23.0%)

Table 2: Discrimination Measures of the two Dimension in CATPCA-1

Perameters	Dimension1	Dimension2	Mean
TND	0.014	0.015	0.015
TND	0.014	0.015	0.015
TNCA	0.006	0.01	0.008
MA	0.013	0.021	0.017
MH	0.03	0.151	0.09
MW	0.023	0.074	0.049
ME	0.277	0.087	0.182
CHD	0.074	0.109	0.092
MEDU	0.068	0.054	0.061
HOA	0.064	0.039	0.052
HOC	0.024	0.037	0.03
LHW1	0.126	0.107	0.117
LHW2	0.427	0.189	0.308
AN6	0.379	0.382	0.38
AN3	0.718	0.096	0.407
SL1	0.386	0.532	0.459
SL2	0.711	0.258	0.485
FM1	0.403	0.518	0.46
FM2	0.703	0.302	0.502
VB1	0.396	0.594	0.495
VB2	0.713	0.319	0.516
VD1	0.39	0.577	0.484
VD2	0.71	0.29	0.5
NU6	0.035	0.122	0.078
NU3	0.57	0.119	0.344
BP6	0.174	0.23	0.202
BP3	0.444	0.139	0.291
TPA	0.047	0.049	0.048
PDU	0.024	0.028	0.026
FA	0.811	0.506	0.659
Districts	0.546	0.092	0.319

Table 3: Variance Accounted using all Parameters in CATPCA-2

Dimension	Cronbach's Alpha	Total (Eigenvalue)	Inertia
1	0.945	9.006	0.530
2	0.919	7.420	0.436
Total		16.425	0.966

Table 4: Correlation coefficient Matrix of the Parameters used in CATPCA-2

g	ME	LHW 1	LHW 2	AN6	AN3	SL1	SL2	FM1	FM2	VB1	VB2	VD1	VD2	NU3	BP6	BP3	FA
ME	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LHW1	0.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LHW2	0.2	0.2	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AN6	0.2	-0.2	0.2	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
AN3	0.2	0.3	-0.1	0.2	1.0	-	-	-	-	-	-	-	-	-	-	-	-
SL1	0.2	-0.2	0.2	0.9	0.2	1.0	-	-	-	-	-	-	-	-	-	-	-
SL2	0.2	0.3	-0.1	0.2	1.0	0.2	1.0	-	-	-	-	-	-	-	-	-	-
FM1	0.2	-0.2	0.2	0.9	0.2	0.9	0.2	1.0	-	-	-	-	-	-	-	-	-
FM2	0.2	0.3	-0.1	0.2	1.0	0.2	1.0	0.2	1.0	-	-	-	-	-	-	-	-
VB1	0.2	-0.1	0.2	0.9	0.2	0.9	0.2	0.9	0.2	1.0	-	-	-	-	-	-	-
VB2	0.2	0.3	-0.1	0.2	1.0	0.2	1.0	0.2	1.0	0.2	1.0	-	-	-	-	-	-
VD1	0.2	-0.1	0.2	0.9	0.2	0.9	0.2	0.9	0.2	1.0	0.2	1.0	-	-	-	-	-
VD2	0.2	0.3	-0.1	0.2	1.0	0.2	1.0	0.2	1.0	0.2	1.0	0.2	1.0	-	-	-	-
NU3	0.5	0.1	0.3	0.3	0.5	0.3	0.5	0.3	0.5	0.3	0.5	0.3	0.5	1.0	-	-	-
BP6	0.2	0.0	0.2	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.4	1.0	-	-
BP3	0.5	0.1	0.3	0.3	0.5	0.3	0.5	0.3	0.5	0.3	0.5	0.3	0.5	1.0	0.4	1.0	
FA	0.4	0.3	0.6	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4	0.6	0.4	0.6	1.0

*Level of significance; p<0.05**

The correlation matrix of CATPCA-2 shows that Anemia during 6 months of pregnancy (AN6) is highly correlated about to be (0.9), with the swelling of feet, fatal movement during 6 months of pregnancy (FM1), Vaginal bleeding during 6 months of pregnancy (VB1) and the white vaginal discharge during the 1st and 2nd trimester of the pregnancy (Table 3).

Multinomial logistic regression is applied to examine the Treatment effect compared to the control or reference groups. Table-5 shows the coefficients for each logistic regression equation of the treatment group1 in the column labeled B.

The constant term or the estimated log odd for TG1 versus control is -8.129. Mother height for TG1 versus a control group of both the different heights is statistically significant. Mother weight variable for less than 45kg and between 45-80kg has a significant impact in TG1 versus the control group. The number of LHW antenatal exams during the 1st and 2nd trimesters is significant for all numbers of exams in TG1 with the odds ratio of (5.353, 1.342, 2.415). Almost 34.2% of females receive more than one number of visits from LHWs in TG1. Anemia in 3rd trimester is a significant impact (odd-ratio= 2.177) 17% of the mothers are 2-times more likely to have Anemia during last 3 months the pregnancy in TG1 versus a control group table 4.

Table 5: Multinomial Logistic Regression coefficients of Treatment group-1

TG-1		B	Std.Error	P-Value	Odd-Ratio
intercept		-8.129	1.703	0.00***	
MH	>4.8 inch	-2.903	0.046	0.00***	0.055
	<4.8 inch	-2.642	0.056	0.00***	0.071
MW	<45 kg	-0.57	0.073	0.00***	0.566
	45-80 kg	-0.402	0.038	0.00***	0.669
LHW1	0	1.678	0.328	0.00***	5.353
	1	0.294	0.079	0.00***	1.342
	2	0.882	0.094	0.00***	2.415
LHW2	0	1.571	0.238	0.00***	4.809
	1	0.287	0.082	0.00***	1.332
	2	0.183	0.073	0.012*	1.2
AN6	Yes	0.443	0.328	0.176	1.558
AN3	Yes	0.778	0.218	<0.01	2.177
SL1	Yes	0.902	0.27	0.00***	2.465
SL2	Yes	0.589	0.23	0.01*	1.802
FM1	Yes	0.497	0.261	0.057	1.643
FM2	Yes	-1.17	0.254	0.00***	0.31
VB1	Yes	0.508	0.327	0.121	1.661
VB2	Yes	0.795	0.308	0.00***	2.214
VD1	Yes	0.276	0.341	0.419	1.317
VD2	Yes	0.988	0.294	0.00***	2.686
NU6	0	2.508	0.148	0.00***	12.279
	1	1.536	0.115	0.00***	4.646
	2	1.083	0.124	0.00***	2.953
BP6	<140/90	1.928	0.093	0.00***	6.879
	>140/90	2.411	0.126	0.00***	11.149
BP3	<140/90	1.672	0.128	0.00***	5.322
	>140/90	1.338	0.148	0.00***	3.813
TPA	Doctor	-0.288	0.044	0.00***	0.75
	LHW	0.881	0.039	0.00***	2.414
	CMW	0.877	0.064	0.00***	2.405

Level of significance; p<0.05, p<0.01**, p<0.001****

Almost 80% (odd-ratio= 1.802) of females are more likely to have a problem with swelling of feet during the last 3 months of pregnancy. Fetal movement, vaginal bleeding, and white vaginal discharge in the 3rd trimester for TG1 have a statistically significant result compared to the control group. Mother's antenatal visits during pregnancy are statistically significant. The odd ratio (12.279) shows that 27.9% of females are 12-times more likely to have no antenatal visits during pregnancy. Type of skill birth attend during pregnancy have a significant impact. Findings show that 41% of females are 2-times more likely to have LHW as a skill birth attendant in TG1 (Table-5). Furthermore, if data have a problem of multicollinearity which resulted into large standard errors (over2) for the independent variables and very large B coefficients. None of the standard errors are (over2) so there is no evidence of numeric problems with this analysis.

The coefficients of the treatment group 2 (TG2), versus the control group, shows that Mother height and weight for TG2 versus a control group at different levels are statistically significant. Females with a weight between 45-80kg are 5-times more likely in TG2 versus the control

group with the odd-ratio of (5.276). The number of LHW antenatal exams during 6 months is significant for all exams in TG2 versus the control group. Anemia during 6 months with the odd-ratio (2.426) shows that 42.6% of mothers are 2-times more likely to have a problem of Anemia during 6 months in TG2 than the control group. Swelling of feet for all trimesters has a significant impact (Table-6). Almost 68.9% of females are 5-times more likely to have a problem of swelling of feet during the last 3 months of pregnancy in TG2. Fetal movement during 6 months and 3rd trimester for TG2 had a statistically significant result versus a control group. Vaginal bleeding for 6 months and 3rd trimester all have significant results for TG2 versus the control group. White vaginal discharge for the 3rd trimester has significant results for TG2 compared to the control group. The odds ratio of (2.621) shows that almost 62.1% of women's are 2-times more likely to suffer from this problem during the 3rd trimester of their pregnancy in TG2. Blood pressure for all trimesters has a significant result. Type of skill birth for all attendants is significant. Odd-ratio of (2.733) shows that 73.3% of mother's are 2-times more likely to have LHWs as skilled birth attendants. Mother education has a significant impact on TG2 versus the control group (Table-6).

The Cox and Snell measures work like R, with higher values showing better model fit. However, this measure is restricted, so unable to achieve the most extreme estimation of 1. Nagelkerke proposed a revision extending from 0 to 1. we connected our interpretive criteria to the Nagelkerke R-square. We may describe the relationship in the model is good in that our model explains the 50% variation of the total variance (Table-7).

Table 6: Multinomial Logistic Regression coefficients of Treatment group-2

TG-2		B	Std.Error	P-Value	Odd – Ratio
Intercept		-7.332	1.573	0.00***	
MH	>4.8 inch	-2.057	0.046	0.00***	0.128
	<4.8 inch	-2.388	0.057	0.00***	0.092
MW	<45 kg	0.805	0.076	0.00***	2.236
	45-80 kg	1.663	0.043	0.00***	5.276
	>80 kg	0.734	0.133	0.00***	2.084
LHW1	0	2.171	0.354	0.00***	8.767
	1	-0.204	0.075	0.006**	0.815
	2	1.019	0.088	0.00***	2.771
LHW2	0	2.23	0.237	0.00***	9.303
	1	0.067	0.078	0.388	1.069
	2	-0.042	0.068	0.544	0.959
AN6	Yes	0.886	0.347	0.011*	2.426
AN3	Yes	0.326	0.212	0.125	1.385
SL1	Yes	0.848	0.281	0.003**	2.334
SL2	Yes	1.739	0.24	0.00***	5.689
FM1	Yes	1.072	0.27	0.00***	2.921
FM2	Yes	-1.05	0.257	0.00***	0.35
VB1	Yes	1.156	0.353	0.00***	3.178
VB2	Yes	1.027	0.29	0.00***	2.793
VD1	Yes	-0.223	0.309	0.47	0.8
VD2	Yes	0.964	0.264	0.00***	2.621
NU6	0	0.618	0.126	0.00***	1.856
	1	-0.041	0.107	0.703	0.96
	2	-0.528	0.119	0.00***	0.59
BP6	<140/90	0.621	0.068	0.00***	1.861
	>140/90	0.817	0.108	0.00***	2.263
BP3	<140/90	0.843	0.104	0.00***	2.324
	>140/90	0.847	0.125	0.00***	2.333
TPA	Doctor	0.372	0.042	0.00***	1.45
	LHW	1.005	0.039	0.00***	2.733
	CMW	0.905	0.065	0.00***	2.472
ME	Illiterate	0.059	0.047	0.212	1.06
	<=11	0.642	0.072	0.00***	1.901

Level of significance; p<0.05, p<0.01**, p<0.001****

Table 7: Goodness of Fit and Pseudo R-square of the Logistic Model

Goodness of fit	Chi-Square	Df	Sig.
Pearson	54720.712	26714	0.00***
Deviance	36195.322	26714	0.00***
Pseudo R-Sauare			
Cox and Snell	.442		
Nagelkerke	.500		
McFadden	.270		

*Level of significance; p<0.05**

Discussion

This study uses an appropriate modeling framework to explain the risk factors for maternal health and LHWs participation in the community health center. The results suggest that LHWs have provided reasonable antenatal coverage to each pregnant lady Odds ratio (7.156, 7.258) of the Third time examine of LHWs in the 3rd trimester, percentage points (38.4% and 42.9%) shows that pregnant ladies were more preferably examine through LHW.

Furthermore, each woman has been examined for Anemia, swelling of feet, fetal position, vaginal discharge, and vaginal bleeding. Results also suggest that ladies are mainly affected by internal health-related problems. Anemia, swelling of the feet, and white vaginal discharge are the basic issues that affect the mother's health. In TG1, 36.7% and TG2, 41.3% of women suffer from vaginal bleeding in the 3rd trimester of their pregnancy. Mother education plays a significant role as educated mothers prefer skilled birth care during pregnancy but are less likely to occur in both treatment groups. In TG1, only 40% of women having one antenatal visit to a health center during their six-month pregnancy is another important factor affecting the mother's health. In TG1, 60% and in TG2, 50% of pregnant ladies have no antenatal visit during their six months. Table.5 random-effects parameters identify that health facility center participation is insignificant, revealing that health centers have many variations within each district.

Improvement-based steps will be needed at equal bases in all health centers. The coverage of reported antenatal visits for the health canter seems less impressive than examining through LHW or community health midwives (CMW). The results imply more improvement in favor of mid-level skilled birth attendance LHW/CMW than qualified doctors. Because most of the women in the survey chose the normal mode of delivery, LHWs/CMWs play better participation than the doctors. The completely safe planned birth record in two Districts shows a significant impact in both treatment groups as compared to the control group. However, the facilities that are provided in the two Districts are insignificant. The one reason for variation within facilities is that pregnant women have multiple skilled birth attendance (public and private) to choose from other than the facility health centers provided in a survey. The above data clearly shows that for making birthing safer, the postnatal care of neonate and mother is important for mother and child's survival.

Conclusion

The study demonstrated the risk factors affecting maternal health of pregnant women and role of LHW/CMW by using multivariate modelling. Multinomial logistic regression predicted that pregnant women were at risk mainly due to internal health issues, subsequently taking less provision of skill birth attendance at both Districts. Multinomial logit show less effective participation of health centers in both Districts, only 40% of ladies in TG1 used health centers for their place delivery. No significant participation of doctors was captured in both treatment groups. Study found that women suffered from internal health issues, and half of them had no antenatal visit at all in six months of pregnancy in both treatment groups. Antenatal visit by LHWs is more effective than the antenatal visit

reported in health centers. It clearly indicates the need to improve the quality of facilitation provided in health centers and the need for instrument-assisted deliveries, especially by mid-level skill birth attendants. CATPCA gave a precise combination of the risk factors significantly contributing in maternal mortality. Seventeen components explained 96.6% of variation in data, of which 12 are mainly related to internal health issues of women. However, on the whole, facilities for the skill birth care provided to a woman during pregnancy are remarkable to achieve the expectation for the reduction of neonatal and maternal mortality in the two districts to make birthing safe for the women. Model may be replicated in other districts of Pakistan to reduce the maternal mortality and for the provision of better maternal health care related services.

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