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Background

In recent decades, strides have been made, globally, to married variable was a binary variable with "Yes" and "No" responses.

Continuous variables	Urban (n = 5891)	Rural (n = 7184)
	mean ± SD	mean ± SD
Dependent Variable		
Pregnancy Loss	0.59 ± 0.98	0.54 ± 0.96
Independent Variables		
Maternal Factors		
Maternal age	33.88 ± 8.15 years	33.25 ± 8.25 years
Categorical Variables	**n (%)**	**n (%)**
Community Level Factors		
Region of residence		
Punjab	1950 (31.8%)	2084 (28.2%)
Sindh	1224 (20.0%)	1357 (18.4%)
Khyber Pakhtunkhwa	1156 (18.8%)	1438 (19.5%)
Balochistan	801 (13.1%)	868 (11.8%)
Gilgit-Baltistan	294 (4.8%)	835 (11.3%)
Azad Jammu and Kashmir	707 (11.5%)	801 (10.8%)
Socioeconomic Factors		
Wealth index		
Lowest	299 (4.9%)	2223 (30.1%)
Second	716 (11.7%)	2112 (28.6%)
Middle	1381 (22.5%)	1408 (19.1%)
Fourth	1644 (26.8%)	991 (13.4%)
Highest	2092 (34.1%)	649 (8.8%)
Maternal education level		
No education	2235 (37.9%)	4363 (60.7%)
Less than 9 years	1576 (26.8%)	1627 (22.7%)
9–12 years	1349 (22.9%)	857 (11.9%)
13 years or more	731 (12.4%)	337 (4.7%)
Maternal Factors		
Currently married		
Yes	5649 (95.9%)	6901 (96.1%)
No		

facility. Further, 21.6% of rural women report open defecation while only 2.0% of urban women report open defecation. Majority of rural women reside in a village that is 31 min or more from the nearest health facility. LHWs are present in only 56.4% of rural villages.

Table 2 describes the bivariate and multivariate results for the urban areas. The multivariate results find maternal education, maternal age, current marital status, and type of sanitation facility to be associated with pregnancy loss in urban areas. Women with less than 9 years of education had an adjusted pregnancy loss IRR that was 18% higher (IRR: 1.18; 95% CI: 1.06, 1.32) than women with no education. Each year of increase in age was associated with an adjusted pregnancy loss IRR of 1.03 (95% CI: 1.02, 1.04). Compared to currently married women, those who reported not being currently married had an adjusted pregnancy loss IRR that was 38% lower (IRR: 0.62; 95% CI: 0.49, 0.78). Women who reported accessing unimproved sanitation facilities had a 35% higher (IRR: 1.35; 95% CI: 1.11, 1.64) pregnancy loss incidence when compared to women who accessed improved sanitation facilities. The conditional alpha value is greater than 0, an indication that the mixed effects negative binomial model is better fitting due to overdispersion in the outcome variable. The cluster variable has an associated coefficient of 0.09, indicating that approximately 9% of the variation in pregnancy loss incidence can be attributed to clusters.

Table 3 outlines the results from the bivariate and multivariate analyses for the rural areas. In rural areas, the multivariate analysis revealed region of residence, wealth index, maternal age, current marital status, drinking water source, cooking fuel type, and type of sanitation facility to be associated with pregnancy loss incidence. Compared to residing in rural Punjab, residing in rural Khyber Pakhtunkhwa was associated with an adjusted incidence of pregnancy loss that was 14% lower (IRR: 0.86; 95% CI: 0.74, 0.99), rural Balochistan with 24% lower (IRR: 0.76; 95% CI: 0.63, 0.91), and residing in rural Gilgit-Baltistan with a pregnancy loss incidence 19% lower (IRR: 0.81; 95% CI: 0.67, 0.97). Women from the highest wealth quintile had an adjusted pregnancy loss IRR of 0.73 (95% CI: 0.57, 0.93) when compared to women from the lowest wealth quintile. Each year of increase in age was associated with an adjusted pregnancy loss IRR of 1.03 (95% CI: 1.03, 1.04). Women who reported not being currently married had a 24% lower (IRR: 0.76; 95% CI: 0.61, 0.93) pregnancy loss incidence when compared to those who reported being currently married. Accessing unimproved source of drinking water over improved was associated with a 17% higher (IRR: 1.17; 95% CI: 1.01, 1.37) adjusted pregnancy loss incidence. Compared to cooking with clean fuels, cooking with solid fuels was associated with an adjusted pregnancy loss IRR of 0.85 (95% CI: 0.75, 0.97). Compared to women using improved sanitation facilities, women who reported open defecation had an adjusted pregnancy loss incidence, 19% higher (IRR: 1.19; 95% CI: 1.05, 1.36). The conditional alpha value being greater than 0 indicates that the mixed effects negative binomial model is better fitting due to overdispersion in the outcome variable. The cluster variable coefficient of 0.10 indicates that approximately 10% of the variation in pregnancy loss incidence can be attributed to cluster variations.

Table 3 Bivariate and multivariate analyses of pregnancy loss predictors among rural women

Independent Variables	Unadjusted IRR (95% CI)	*p*-value	Adjusted IRR (95% CI)	*p*-value
Community Level Factors				
Region of residence (n = 7184)				
Punjab (n = 2030)	Ref.	Ref.	Ref.	Ref.
Sindh (n = 1320)	1.11 (0.97, 1.27)	0.135	1.01 (0.86, 1.17)	0.937
Khyber Pakhtunkhwa (n = 1408)	0.87 (0.76, 1.00)	0.054	**0.86 (0.74, 0.99)**	**0.041**
Balochistan (n = 838)	**0.82 (0.70, 0.97)**	**0.019**	**0.76 (0.63, 0.91)**	**0.003**
Gilgit-Baltistan (n = 802)	**0.84 (0.71, 0.99)**	**0.036**	**0.81 (0.67, 0.97)**	**0.021**
Azad Jammu and Kashmir (n = 786)	0.91 (0.77, 1.07)	0.238	0.85 (0.72, 1.01)	0.065
Socioeconomic Factors				
Wealth index (n = 7184)				
Lowest (n = 2164)	Ref.	Ref.	Ref.	Ref.
Second (n = 2057)	0.92 (0.82, 1.02)	0.121	1.00 (0.88, 1.13)	0.982
Middle (n = 1376)	0.92 (0.82, 1.04)	0.201	0.98 (0.84, 1.15)	0.832
Fourth (n = 962)	**0.87 (0.75, 1.00)**	**0.045**	0.84 (0.70, 1.02)	0.082
Highest (n = 625)	**0.81 (0.68, 0.96)**	**0.014**	**0.73 (0.57, 0.93)**	**0.011**
Maternal education level (n = 7184)				
No education (n = 4363)	Ref.	Ref.	Ref.	Ref.
Less than 9 years (n = 1627)	0.95 (0.86, 1.05)	0.278	1.11 (0.99, 1.24)	0.076
9–12 years (n = 857)	**0.86 (0.75, 0.99)**	**0.031**	1.14 (0.98, 1.33)	0.093
13 years or more (n = 337)	**0.64 (0.52, 0.80)**	**< 0.001**	0.83 (0.65, 1.06)	0.13
Maternal Factors				

Discussion

This study identified distant factors associated with pregnancy loss among ever-married women in urban and rural areas of Pakistan. The prevalence of pregnancy loss was higher in urban areas than rural areas. Since the PMMS dataset lacks primary sampling unit and strata variables, the prevalence estimates are not directly comparable to existing literature, which typically account for sampling design. The split analyses of urban and rural areas revealed that the factors associated with pregnancy loss differed between these contexts.

Consistent with the existing literature, rural areas of Khyber Pakhtunkhwa, Balochistan, and Gilgit-Baltistan had lower pregnancy loss incidence when compared to rural Punjab [8]. The poor pregnancy outcomes in rural other rural regions, but no significant differences were seen between the urban parts of the regions. The exemplary rural regions with lower pregnancy loss incidence rates can serve as potential models, prompting further research to understand the differences in healthcare administration leading to the protective effects.

In rural areas, it appears that financial hardships may be contributing to the burden of pregnancy loss. Policies targeted towards reducing the financial barriers to accessing healthcare, specifically in rural areas, would prove beneficial. Policies should be targeted towards improving or at least offsetting the wealth disparities within communities. This could be carried out by bolstering and increasing support for the LHW Program which is responsible for administering primary healthcare services to rural areas. Previous researchers have shown that

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