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Antenatal Care Utilization and Its Determinants Among Rural, Urban, and Rural-Migrant Women in Karachi, Pakistan: A Comparative Study.

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Abstract

Background: Rural-urban disparities in antenatal care (ANC) utilization are well-documented in Pakistan, but little is known about rural women who migrate to urban areas for childbirth. This study compared ANC utilization among three groups in Karachi: rural residents with rural birth (Group A), urban residents with urban birth (Group B), and rural residents with urban birth (Group C). ***Methods:*** A comparative cross-sectional study was conducted among 207 women who had given birth within the preceding 12 months (69 per group). Data were collected using a structured interview schedule. ANC adequacy was defined as four or more visits. Chi-square tests, one-way ANOVA with Welch's correction, and binary logistic regression were used. ***Results:*** Just over three-quarters of the women (77.3%) had adequate ANC. Adequacy was lowest in Group A (62.3%) and clearly higher in Groups B (85.5%) and C (84.1%); the difference between the three groups was significant ($\chi^2 = 13.27$, $p = .001$). Mean ANC visits were 3.45 (Group A), 3.81 (Group B), and 3.68 (Group C) ($F = 4.21$, $p = .016$); Group A had significantly fewer visits than Group B (mean difference = −0.36, $p = .009$). After adjustment for education, spouse education, and household size, Group B had 3.32 times the odds (95% CI: 1.33–8.26) and Group C had 2.99 times the odds (95% CI: 1.32–6.79) of adequate ANC compared with Group A. Socioeconomic covariates were not significant. Distance to hospital ($p = .017$) and hospital type ($p < .001$) differed significantly across groups. ***Conclusions:*** ANC utilization was significantly lower among rural women compared to urban and rural-migrant women. Migration for delivery was associated with utilization comparable to urban women, unexplained by socioeconomic factors. Targeted interventions are needed for rural women in Pakistan.

Keywords: Antenatal care, Maternal health, Rural-urban disparities, Migration, Pakistan, Three Delays Model.

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INTRODUCTION

The urban advantage in antenatal care (ANC) has been reported consistently across developing countries. A meta-analysis of 51 studies found that urban mothers were almost three times as likely as rural mothers to receive ANC (OR 2.95, 95% CI 2.23–3.89)1. The pattern holds across South Asia. In Bangladesh and Pakistan, urban women were 20–25 percentage points more likely to receive quality ANC than rural women, and most of this gap was explained by wealth, education and media exposure rather than by differences in behaviour2–4. Pakistan's national data repeat the finding: rural women are less likely than urban women to receive ANC, skilled birth attendance or postnatal care5,6. For this reason, rural residence is widely used as a marker of disadvantage in maternal health policy globally7,8.

What this literature does not resolve is the position of women who move from rural to urban areas. Studies of internal migration report opposite findings, and the direction appears to depend on the setting and the type of move. In India, women who migrated temporarily for childbirth, returning to a natal home or moving to a city before delivery, had more access to maternal health care than non-migrants, not less9–11. In sub-Saharan Africa, by contrast, female internal migrants faced roughly 25% higher financial and geographic barriers to care than non-migrants12–14. A national analysis in Pakistan found that internal migration was associated with greater use of reproductive and maternity care, but the association

weakened once education and wealth were taken into account, suggesting selection rather than migration itself6,15–17. The direction of the effect appears to depend on whether the move is planned and resourced18,19.

For Pakistan, the question is still open. Rural families commonly send a pregnant woman to stay with urban relatives, or to arrange temporary accommodation near a hospital, in the weeks before delivery20. These women are not permanent migrants, and they are not delivering locally either. Most applications of the Three Delays Model compare rural with urban women and leave this intermediate group out, so it remains unclear whether their ANC use resembles that of urban women, rural women, or neither; whether any advantage survives adjustment for education, spouse education and household size; and how distance, transport and hospital type shape access across the three groups21–24. A three-group comparison that separates residence from place of birth is needed to answer these25.

Study objectives: The study had four objectives: to compare ANC use among rural, urban and rural-migrant women in Karachi; to identify the sociodemographic and access-related factors linked to adequate ANC; to see whether group differences held after adjusting for education, spouse education and household size; and to describe access barriers, distance, transport and hospital type across the three groups.

Hypotheses: H1: Rural-migrant women (Group C) are expected to show greater ANC adequacy than rural non-migrant women (Group A), though less than urban non-migrant women (Group B). H2: Once education, spouse education and household size are taken into account, the gap between groups should narrow but remain statistically significant.

This study contributes evidence on the ANC use among rural-migrant women, tests the Three Delays Model across three groups rather than the usual two, and sets out the barriers that policy in Sindh and comparable settings will need to address.

MATERIALS AND METHODS

Study design and setting: This was a comparative cross-sectional study with retrospective data collection, carried out in Karachi, Pakistan. Karachi is Pakistan's largest city, with an estimated population of more than 26 million. Women were recruited from two rural areas (Gadap Town and Malir Town) and four urban areas (Saddar, DHA, Gulshan-e-Iqbal and Nazimabad).

Participants: Women were eligible if they were aged 20–40 years, had given birth in the preceding 12 months, lived in one of the selected areas, and gave informed consent. Women with severe mental or physical illness, and those who declined to take part, were excluded.

Study groups: Women were assigned to one of three groups according to their area of residence (residence_area: 1 = rural, 2 = urban) and the area where their youngest child was born (last_area, derived from the child-level records c1–c10).

- Group A (n = 69): were rural-resident women who gave birth in a rural area;
- Group B (n = 69): were urban-resident women who gave birth in an urban area; and
- Group C (n = 69): Rural residence, urban birth. These are rural migrant, comprised of women whose residence area was recorded as rural but whose youngest child was born in an urban area.

The youngest child was identified using the minimum age code across all children, ensuring the most recent birth was used regardless of entry order.

Sample size: A total of 207 women (69 per group) were recruited. This provided 80% power to detect a medium effect size (Cohen's $w = 0.25$) at $\alpha = 0.05$. Non-probability purposive sampling method was used. No group assignments were missing in the study.

Data collection: A structured interview schedule was prepared after reviewing the literature and was pre-tested on 10 women, who were not included in the final sample. The schedule had 78 questions covering demographic details, education, family history, social relations, migration, economic status, housing, health status, healthcare access, family planning, reproductive history, ANC, FGM, birth outcomes and child data. Interviews lasted 45–60 minutes and were conducted by trained female data collectors fluent in Urdu and Sindhi. Written informed consent was taken, and for women who could not read, it was read aloud in front of a witness. To maintain data quality, interviewers received three days of training, and supervision, completeness checks and double data entry were carried out daily.

Variables: Adequate antenatal care (ANC) was the outcome, coded 1 for four or more visits and 0 for fewer than four. Group membership was the main independent variable, entered as dummy variables with Group A as the reference. Maternal education, spouse education and household size were used as socioeconomic covariates. Access was measured through distance to hospital, mode of transport and hospital type. Other variables examined were maternal age, birth place, occupation, age at marriage, parity, family type, marriage type, domestic violence, husband's respect and migration status.

Statistical analysis: Analyses were carried out in IBM SPSS Statistics version 22.0. Frequencies, percentages, means and standard deviations were used to describe the sample overall and within each group. Group membership was cross-tabulated against categorical variables using chi-square tests, and Fisher's exact test was used where more than 20% of cells had expected counts below 5. Mean ANC visits were compared across groups using one-way ANOVA. Levene's test checked homogeneity of variance, and Welch's ANOVA was used where variances differed. For post-hoc comparisons, Tukey HSD was used when variances were equal and Games-Howell when they were not. Binary logistic regression was used to identify predictors of adequate ANC. Model fit was checked with the Omnibus test, the Hosmer–Lemeshow test and Nagelkerke R^2.

Ethics: The study followed the Declaration of Helsinki and was approved by the BASR, Department of Sociology, University of Karachi. All data were anonymized.

RESULTS

Sample characteristics: The 207 women ranged in age from 20 to 40, with a mean of 27.6 years. Almost all (96.1%) were between 20 and 35. Households were mostly large: 60.4% had six or more members, and 94.2% lived in joint or extended families. Just over half of the women (58.5%) and 70.7% of their spouses had completed secondary schooling or above. A little over half (55.1%) were born in Karachi, and 29.0% had moved there from another city.

Table 1 reports characteristics by group. Education, occupation, parity, place of birth, migration status, residence type, domestic violence and husband's respect all differed significantly (all $p < .05$). Secondary education or above was reported by 79.7% of Group B, 55.1% of Group C and 40.6% of Group A ($p < .001$). Daily wage work was largely confined to Group A (21.7%), with 10.1% in Group C and none in Group B ($p < .001$). Three or more children were more common in Group A (62.3%) than in Group B (49.3%) or Group C (37.7%; $p < .001$). Most of Group B was born in Karachi (92.8%) and had the lowest migration rate (8.7%), while Groups A and C shared the same rate (39.1% each; $p < .001$). Domestic violence was highest in Group C (23.2%), followed by Group A (20.3%) and Group B (7.2%; $p = .029$). High husband's respect was most often reported by women in Group B (79.7%), then Group C (66.7%) and Group A (58.0%; $p = .032$). Age, age at marriage, household size, family type, residence ownership, spouse income, marriage type, first cousin marriage and polygyny showed no significant differences.

Table 1. Socio-demographic and reproductive characteristics of participants by study group (N = 207)

Characteristic	Group A (n=69) n (%)	Group B (n=69) n (%)	Group C (n=69) n (%)	p-value
Maternal age				.172[a]
20–25 years	26 (37.7)	29 (42.0)	35 (50.7)	
26–35 years	38 (55.1)	37 (53.6)	34 (49.3)	
36–40 years	5 (7.2)	3 (4.3)	0 (0.0)	
Education				**<.001**
No education	20 (29.0)	4 (5.8)	16 (23.2)	
Primary	21 (30.4)	10 (14.5)	15 (21.7)	
Secondary or higher	28 (40.6)	55 (79.7)	38 (55.1)	
Spouse education				.067
No education	12 (17.4)	7 (10.1)	6 (9.0)	
Primary	13 (18.8)	6 (8.7)	16 (23.9)	
Secondary or higher	44 (63.8)	56 (81.2)	45 (67.2)	
Occupation				**<.001[a]**
Housewife	42 (60.9)	61 (88.4)	42 (60.9)	
Daily wages	15 (21.7)	0 (0.0)	7 (10.1)	
Other	12 (17.4)	8 (11.6)	20 (29.0)	
Age at marriage				.167
Under 18 years	11 (15.9)	8 (11.6)	13 (18.8)	
18–22 years	35 (50.7)	28 (40.6)	35 (50.7)	
23+ years	23 (33.3)	33 (47.8)	21 (30.4)	
Parity				**<.001**
1 child	4 (5.8)	25 (36.2)	40 (58.0)	
2 children	22 (31.9)	10 (14.5)	3 (4.3)	
3 or more	43 (62.3)	34 (49.3)	26 (37.7)	
Household size				.818[a]
Small (1–2)	2 (2.9)	1 (1.4)	3 (4.3)	

Medium (3–5)	23 (33.3)	27 (39.1)	26 (37.7)	
Large (6+)	44 (63.8)	41 (59.4)	40 (58.0)	
Family type				.156[a]
Joint/alone	62 (89.9)	67 (97.1)	66 (95.7)	
Nuclear	7 (10.1)	2 (2.9)	3 (4.3)	
Residence type				**.019[a]**
Bungalow	14 (20.3)	25 (36.2)	21 (30.4)	
Quarter	13 (18.8)	10 (14.5)	16 (23.2)	
Apartment	27 (39.1)	28 (40.6)	17 (24.6)	
Shanty/other	15 (21.8)	6 (8.7)	15 (21.7)	
Residence ownership				.435[a]
Self/parents	33 (47.8)	40 (58.0)	36 (52.2)	
Spouse	13 (18.8)	14 (20.3)	10 (14.5)	
Rented	15 (21.7)	11 (15.9)	18 (26.1)	
Other	8 (11.6)	4 (5.8)	5 (7.2)	
Spouse income				.083[a]
<10,000	3 (4.3)	5 (7.2)	7 (10.1)	
10,001–20,000	35 (50.7)	23 (33.3)	25 (36.2)	
20,001–30,000	23 (33.3)	22 (31.9)	22 (31.9)	
30,001+	8 (11.6)	19 (27.5)	15 (21.7)	
Birth place				**<.001**
Karachi	22 (31.9)	64 (92.8)	28 (40.6)	
Outside Karachi	47 (68.1)	5 (7.2)	41 (59.4)	
Migration status				**<.001**
Migrated	27 (39.1)	6 (8.7)	27 (39.1)	
Not migrated	42 (60.9)	63 (91.3)	42 (60.9)	
Marriage type				.068
Arranged	64 (92.8)	63 (91.3)	56 (81.2)	
Non-arranged	5 (7.2)	6 (8.7)	13 (18.8)	
First cousin marriage				.367
Yes	27 (39.1)	22 (31.9)	30 (43.5)	
No	42 (60.9)	47 (68.1)	39 (56.5)	
Polygyny				.075
Only you	62 (89.9)	68 (98.6)	62 (89.9)	
Two or more	7 (10.1)	1 (1.4)	7 (10.1)	
Domestic violence				**.029**
Yes	14 (20.3)	5 (7.2)	16 (23.2)	
No	55 (79.7)	64 (92.8)	53 (76.8)	
Husband respect				**.032[b]**
Low (1–3)	29 (42.0)	14 (20.3)	23 (33.3)	
High (4–5)	40 (58.0)	55 (79.7)	46 (66.7)	

Group A = rural residence, rural birth; **Group B** = urban residence, urban birth; **Group C** = rural residence, urban birth.
[a] Chi-square assumption violated (>20% cells with expected count <5). Distribution reported for descriptive purposes.
[b] Borderline (20% cells with expected count <5).

ANC utilization by group: Overall, 77.3% of women had four or more ANC visits, and 98.6% received ANC from a skilled provider. ANC adequacy differed significantly: 85.5% in Group B, 84.1% in Group C, and 62.3% in Group A (χ^2 = 13.27, df = 2, p = .001; Table 2). Mean ANC visits also differed significantly: 3.81 (SD = 0.52) in Group B, 3.68 (SD = 0.81) in Group C, and 3.45 (SD = 0.85) in Group A (F(2, 204) = 4.21, p = .016). Levene's test indicated unequal variances (p < .001); Welch's ANOVA confirmed significance (F(2, 128.64) = 4.57, p = .012). Games-Howell post-hoc showed that Group A had significantly fewer visits than Group B (mean difference = −0.36, 95% CI: −0.65 to −0.08, p = .009). Differences between Groups A and C (p = .233) and between Groups B and C (p = .503) were not significant. ANC provider type was not analyzed statistically due to near-universal skilled coverage (98.6%).

Table 2. Antenatal care utilization by study group

ANC Outcome	Group A (n=69)	Group B (n=69)	Group C (n=69)	Test statistic	p-value
Adequate ANC (4+ visits), n (%)	43 (62.3)	59 (85.5)	58 (84.1)	χ^2 = 13.27, df=2	**.001**
ANC visits, mean (SD)	3.45 (0.85)	3.81 (0.52)	3.68 (0.81)	F = 4.21	**.016**
Welch's ANOVA	—	—	—	F = 4.57	**.012**
Post-hoc (Games-Howell)					
Group A vs Group B	MD = −0.36				**.009**
Group A vs Group C	MD = −0.23				.233
Group B vs Group C	MD = 0.13				.503

Access barriers by group: Distance to hospital differed significantly (χ^2 = 12.04, df = 4, p = .017; Table 3). Group B had the highest proportion within 1 km (30.4%); Group C had the highest proportion more than 4 km away (53.6%). Mode of transport did not differ significantly (χ^2 = 6.96, df = 4, p = .138); own transport was most common in Group B (50.7%), and public transport was most common in Group C (49.3%). Hospital type differed significantly (χ^2 = 27.39, df = 4, p < .001). Group B predominantly used private hospitals (73.9%); Group A predominantly used government hospitals (58.0%); Group C showed a mixed pattern (46.4% government, 42.0% private).

Table 3. Access barriers and healthcare facility characteristics by study group

Characteristic	Group A (n=69) n (%)	Group B (n=69) n (%)	Group C (n=69) n (%)	p-value
Distance to hospital				**.017**
Within 1 km	12 (17.4)	21 (30.4)	8 (11.6)	
1–3 km	32 (46.4)	20 (29.0)	24 (34.8)	
Over 4 km	25 (36.2)	28 (40.6)	37 (53.6)	
Mode of transport				.138
Own transport	32 (46.4)	35 (50.7)	22 (31.9)	
Public transport	29 (42.0)	22 (31.9)	34 (49.3)	
Walk/Other	8 (11.6)	12 (17.4)	13 (18.8)	
Hospital type				**<.001**
Government	40 (58.0)	12 (17.4)	32 (46.4)	
Private	25 (36.2)	51 (73.9)	29 (42.0)	
NGO/Other	4 (5.8)	6 (8.7)	8 (11.6)	

Multivariate analysis: The logistic regression model was statistically significant (Omnibus χ^2 = 17.09, df = 5, p = .004; Hosmer-Lemeshow χ^2 = 12.21, df = 8, p = .142; Nagelkerke R^2 = 0.121; 77.8% correctly classified; Table 4). Both Group B and Group C had significantly higher odds of adequate ANC than Group A, and using Group A as reference:

- Group B: OR = 3.32 (95% CI: 1.33–8.26; p = .010)
- Group C: OR = 2.99 (95% CI: 1.32–6.79; p = .009)
- Education: OR = 1.00 (95% CI: 0.78–1.30; p = .974)
- Spouse education: OR = 1.10 (95% CI: 0.88–1.38; p = .406)
- Household size: OR = 0.69 (95% CI: 0.46–1.04; p = .078)

The adjusted odds ratios for group membership were stronger than crude associations, suggesting that the group effect was suppressed rather than confounded by socioeconomic variables.

Table 4. Binary logistic regression predicting adequate antenatal care (4+ visits)

Variable	B	SE	Wald	df	p	OR	95% CI
Group B vs Group A	1.199	0.466	6.623	1	**.010**	**3.32**	1.33–8.26
Group C vs Group A	1.095	0.418	6.858	1	**.009**	**2.99**	1.32–6.79
Education	0.004	0.131	0.001	1	.974	1.00	0.78–1.30
Spouse education	0.097	0.117	0.690	1	.406	1.10	0.88–1.38
Household size	−0.372	0.211	3.115	1	.078	0.69	0.46–1.04
Constant	1.593	0.927	2.951	1	.086	4.92	—

Model fit: Omnibus χ^2 = 17.09, df = 5, p = .004; Hosmer-Lemeshow χ^2 = 12.21, df = 8, p = .142; Nagelkerke R^2 = 0.121; Overall classification = 77.8%.
Reference category: Group A (rural residence, rural birth).

DISCUSSION

Principal findings: This study compared ANC utilization among rural, urban, and rural-migrant women in Karachi. Three findings emerged. First, ANC adequacy differed significantly: 62.3% in Group A, 85.5% in Group B, and 84.1% in Group C ($p = .001$). Adjusted odds of adequate ANC were 3.32 times higher for Group B and 2.99 times higher for Group C compared with Group A, after controlling for education, spouse education, and household size. Socioeconomic covariates were not significant predictors. H2 expected group differences to shrink after adjustment, but the adjusted odds ratios came out stronger than the crude ones. This points to suppression rather than confounding by the socioeconomic variables. However, group C present in between the other two groups. It did not differ significantly from Group B ($p = .503$) or from Group A ($p = .233$), which suggests that migration closes the rural–urban gap only partly.

Interpretation using the Three Delays Model:

Delay 1: Decision to seek care. Group A had the lowest ANC use even though services were available, which suggests the first delay may be at work here. Domestic violence was more common in Groups A (20.3%) and C (23.2%) than in Group B (7.2%), which matches other South Asian studies that identify intimate partner violence as a barrier to maternal healthcare. Husband's respect was lowest in Group A (58.0% high respect) versus Groups B (79.7%) and C (66.7%), indicating weaker marital support associated with reduced healthcare seeking. Parity was high in Group A (62.3% with 3+ children), associated with lower ANC utilization as women may feel less need with subsequent pregnancies. Together, these findings indicate that the decision-making environment for rural women is less conducive to ANC.

Delay 2: Reaching a facility. Distance to hospital differed across groups ($p = .017$). Group C had the highest share living more than 4 km from a hospital (53.6%), yet still reached high ANC use (84.1%). This may be because rural-migrant women planned the move in advance to be closer to care, or because they travelled longer distances and accepted the cost in return for better care, as reported in Bangladesh and India. Mode of transport was similar in all three groups ($p = .138$), so transport availability does not seem to separate them.

Delay 3: Receiving adequate care. Hospital type also differed by group ($p < .001$). Group A mostly used government hospitals (58.0%), Group B mostly private ones (73.9%), while Group C was split almost evenly between the two (46.4% government, 42.0% private). Private hospitals in Pakistan are usually better resourced for ANC, with longer consultations, better equipment and fewer drug stock-outs, which may partly explain the higher ANC adequacy in Group B. Even so, 98.6% of women in all three groups were seen by a skilled provider, so Delay 3 does not seem to be a major barrier in this setting.

Comparison with existing literature:

Urban–rural gaps in ANC use have been reported before. In Ethiopia, 35% of urban women delivered in a facility compared with 20% of rural women; in the Philippines the figures were 79% and 56%. The gap in our sample is similar: 85.5% of urban women reached ANC adequacy against 62.3% of rural women. Internal migration, where it is planned and voluntary, has been linked to higher maternal healthcare use in India and Bangladesh. Group C followed the same pattern and used services more than Group A. Mahmood (2012) found 74% skilled ANC among urban women and 50% among rural women, with education and income as the main determinants. That pattern did not appear in our data: group membership stayed significant after adjustment, while the socioeconomic covariates did not. Group membership may be picking up access to urban infrastructure, social networks, or migration-related factors that lie beyond socioeconomic status.

Policy implications

Several implications follow. The rural–urban gap is wide enough to justify continued investment in rural maternal health services in Sindh. Rural-migrant women reached ANC use close to that of urban women, which suggests that easier access to urban ANC can improve outcomes though migration itself is neither scalable nor equitable. Domestic violence and husband's respect both mattered, so maternal health programs need to address gender dynamics directly, through screening for violence and by involving husbands. More than half of Group C lived beyond 4 km from a hospital, so distance and transport remain practical barriers; transport support or community-level ANC closer to home would help.

Strengths and limitations

Separating residence from place of birth is the main strength of the design, since most studies compare only rural and urban women. Group sizes were equal, the dataset covered several domains, and the analysis used chi-square tests, Welch's ANOVA, Games–Howell post-hoc comparisons and logistic regression.

The limitations are considerable. The cross-sectional design rules out causal inference. Adequate ANC was common (77.3%), which limited the power of the models to identify predictors of inadequate ANC and may leave some estimates unstable. Some variables had missing data, and group assignment came from residence and birth area rather than from an original sampling frame. Chi-square assumptions were violated for several variables, sensitive outcomes were self-reported and open to social desirability bias, and the findings come from Karachi, so they may not extend to rural Pakistan where access is more limited.

CONCLUSION

ANC use differed across the three groups. Rural women had the lowest adequacy (62.3%), urban women the highest (85.5%), and rural-migrant women sat in between at 84.1%, statistically comparable to urban women. Group membership remained a strong predictor after adjusting for education, spouse education and household size. Migration for delivery was therefore linked to better ANC use in ways that socioeconomic characteristics did not explain. The Three Delays Model helps make sense of this. Rural women appear to face delays in deciding to seek care, tied to domestic violence, low husband's respect and high parity. Rural-migrant women may get past these barriers by moving closer to urban facilities. The rural–urban gap that remains points to what is still needed in rural Sindh: work on gender dynamics, involving husbands, and better access to good-quality ANC.

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