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Trends in Age at Marriage, Maternal Age, and Parity Among Women Delivering in Pakistan: A Retrospective Registry-Based Study

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Abstract

Introduction

Maternal age and parity are key determinants of obstetric risk, but annual data on age at marriage, maternal age, and parity among women delivering in Pakistani hospitals are scarce. This study describes trends in these characteristics over nine years.

Methods

This retrospective study analyzed 61,592 delivery records from the Alkhidmat Raazi Obstetric and Gynecological Registry, Rawalpindi, Pakistan, from January 2016 to December 2024. We assessed trends using linear regression for continuous variables and logistic regression for binary variables, with calendar year as a continuous term. Parity trends were additionally adjusted for maternal age group.

Results

Mean maternal age rose from 26.87 years in 2016 to 27.70 years in 2024 [0.11 years per year, 95% confidence interval (CI) 0.10-0.13]. Deliveries to women aged 35 years or older increased from 290/4,029 (7.2%) to 886/7,986 (11.1%) [odds ratio (OR) 1.08 per year, 95% CI 1.07-1.09]. Mean age at marriage rose from 22.36 to 22.85 years, which corresponded to about 0.5 of the 0.8-year rise in maternal age. Marriage before 18 years did not decline, at 390/3,940 (9.9%) in 2016 and 717/7,625 (9.4%) in 2024 ($p = 0.343$). The proportion of nulliparous women was stable after age adjustment, while grand multiparity declined from 97/4,027 (2.4%) to 167/7,971 (2.1%) (adjusted OR 0.933, $p < 0.001$). Maternal age increased with each birth order, most at the fourth birth (0.18 years per year). Among primigravidas, later marriage corresponded to 86% of the rise in maternal age.

Conclusions

Women delivering at this hospital are becoming older, largely in parallel with later marriage, while marriage before 18 years has not declined. Antenatal services should prepare for a growing number of older mothers, and routine registry data can be used to monitor early marriage.

Categories: Obstetrics/Gynecology, Public Health, Epidemiology/Public Health
Keywords: advanced maternal age, age at marriage, child marriage, grand multiparity, maternal age, parity

Introduction

Advanced maternal age is associated with pregnancy complications and adverse neonatal outcomes [1]. Risks are also raised at the younger end of the reproductive span. In a World Health Organization survey of 124,446 mothers in 29 countries, adolescents aged 10-19 years had higher risks of eclampsia, puerperal endometritis, systemic infection, low birth weight, preterm delivery, and severe neonatal conditions than mothers aged 20-24 years [2]. At the other extreme, a meta-analysis of more than 44 million births found that women aged 35 years or older had 75% higher odds of stillbirth [odds ratio (OR) 1.75, 95% confidence interval (CI) 1.62-1.89] [3]. The effect of age on low birth weight was particularly marked in nulliparous women (OR 2.28, 95% CI 1.25-4.13) [3]. Parity similarly interacts with age: the excess risks seen in grand multiparous women, including gestational diabetes, gestational hypertension, and intensive care admission, are largely explained by their older age [4]. Age and parity must therefore be considered together rather than separately.

In high-income countries, childbearing has moved steadily to older ages as women's education, labor-force participation, and access to contraception have expanded [5]. Pakistan is at an earlier stage of this

transition. The total fertility rate fell from more than six births per woman in 1990-91 to 3.6 in 2017-18, while the median age at first marriage rose by 1.8 years and the median age at first birth by 1.5 years [6]. In 2017-18, the median age at first birth was 22.8 years, compared with 22.2 years in 2012-13 [7]. Between 1990-91 and 2017-18, the proportion of married women aged 15-49 years who had married before 18 fell from 54% to 39% [8]. Early marriage remains a strong driver of fertility, as women married before 18 have more than six times the odds of having three or more births (adjusted OR: 6.62, 95% CI 3.53-12.43) [9].

These national estimates come from household surveys conducted at intervals of five years or more [6]. They cannot show year-to-year change, and they do not report how age at marriage, maternal age, and parity relate to one another among women delivering in hospitals. Institutional delivery registries can provide continuous, record-level data to fill this gap.

This study aimed to (1) assess trends in age at marriage, maternal age, and parity among women delivering at a hospital in Rawalpindi, Pakistan, from 2016 to 2024; (2) compare these characteristics between nulliparous and parous women; and (3) determine how maternal age at each birth order changed over this period.

Materials And Methods

Study design and setting

This retrospective study was conducted at Alkhidmat Raazi Hospital, Rawalpindi, Pakistan, using data from the Alkhidmat Raazi Obstetric and Gynecological Registry, which records all deliveries at the hospital. All delivery records from January 2016 to December 2024 with documented maternal age were included (n = 61,592; maternal age 15-49 years). The registry did not allow deliveries by the same woman to be linked, so each delivery was analyzed as a separate record. To reduce the effect of repeated records, trends in age at marriage were also examined in primigravida women, who contribute one record each. The study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Data source and extraction

The Alkhidmat Raazi Obstetric and Gynecological Registry is maintained as a Microsoft Excel file (Microsoft Corporation, Redmond, United States) using a structured data sheet designed by the department. A data entry operator enters each delivery daily from the patient's admission file at the time of discharge, including maternal age, duration of marriage, gravidity, and parity. For this study, all delivery records from January 2016 to December 2024 were extracted, de-identified, and checked for duplicate and implausible entries. Duplicate records were removed, and the final dataset was then analyzed using R statistical software, version 4.6.1 (R Foundation for Statistical Computing, Vienna, Austria).

Variables and definitions

Maternal age at delivery was categorized as < 20, 20-34, and ⩾ 35 years. Age at marriage was calculated by subtracting the duration of marriage, as recorded in the patient's admission file, from maternal age at delivery; values outside 10-45 years were excluded as implausible. Marriage before 18 years was defined as a calculated age at marriage below 18 years. Parity was recorded as the number of previous births and coded as zero for primigravidas, whose parity field was blank in the registry. Women with parity zero were classified as nulliparous and the remainder as parous. Birth order was defined as parity plus one, with fifth and higher-order births pooled. Parity ⩾ 5 was defined as grand multiparity. The marriage-to-first-delivery interval was the duration of marriage at delivery in nulliparous women. Trends in age at marriage, marriage before 18 years, and the marriage-to-delivery interval were also examined separately in primigravida women, and the difference in age-at-marriage trends between primigravida and multigravida women was tested using a year × gravidity interaction term.

Statistical analysis

Continuous variables were summarized as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. Analyses used complete cases without imputation. Parity was missing in 50 records, and age at marriage was missing or implausible in 1,837 records. Trends over time were assessed with linear regression for continuous variables and logistic regression for binary variables, entering calendar year as a continuous term. Results are reported as change per year or OR per year with 95% CI. Parity trends were additionally adjusted for maternal age group. Trends in maternal age were estimated within each birth order and, for the overall trend, after adjustment for birth order. A p-value < 0.05 was considered statistically significant. All statistical analyses were performed using R software, version 4.6.1.

Ethical approval

The Institutional Review Board of Alkhidmat Raazi Hospital (Reference no: IRB/AKRH/P08/26) approved the study. The requirement for informed consent was waived owing to the retrospective design and use of de-identified data.

Results

Study population and baseline characteristics

A total of 61,592 delivery records from January 2016 to December 2024 were analyzed. Annual deliveries ranged from 4,029 in 2016 to 9,509 in 2022. Parity was recorded for 61,542 (99.9%) records and age at marriage for 59,755 (97.0%).

The mean maternal age at delivery was 27.3 ± 4.8 years; 2,061 (3.3%) women were younger than 20 years and 5,521 (9.0%) were 35 years or older. The mean age at marriage was 22.5 ± 4.0 years, and 5,832 (9.8%) had married before 18 years. Of the 61,542 deliveries with known parity, 21,170 (34.4%) were first births and 3,769 (6.1%) were fifth or higher-order births (Table *1*).

Characteristic	n with data	Value
Maternal age at delivery, years, mean ± SD	61,592	27.32 ± 4.79
< 20 years, n (%)		2,061 (3.3)
20–34 years, n (%)		54,010 (87.7)
≥ 35 years, n (%)		5,521 (9.0)
Age at marriage, years, mean ± SD	59,755	22.55 ± 4.03
Married before 18 years, n (%)		5,832 (9.8)
Parity, mean	61,542	1.29
Birth order of current delivery, n (%)	61,542	
First (nulliparous)		21,170 (34.4)
Second		17,662 (28.7)
Third		12,332 (20.0)
Fourth		6,609 (10.7)
Fifth or higher		3,769 (6.1)

TABLE 1: Baseline reproductive characteristics of the study population (N = 61,592)

Data are presented as mean ± SD or n (%). Percentages are based on women with available data for each variable. Percentages use records with available data as the denominator. SD: standard deviation.

Trends in maternal age

Mean maternal age at delivery rose from 26.87 years in 2016 to 27.70 years in 2024, an increase of 0.11 years per calendar year (95% CI 0.10 to 0.13; $p < 0.001$) (Figure *1*, Table *2*). The median remained at 27 years, while the standard deviation widened from 4.53 to 5.13 years, indicating a broadening of the age distribution rather than a uniform shift. Deliveries to women aged 35 years or older rose from 290/4,029 (7.2%) in 2016 to 886/7,986 (11.1%) in 2024 (OR 1.08 per year, 95% CI 1.07-1.09; $p < 0.001$). Teenage deliveries (< 20 years) showed no significant trend, at 137/4,029 (3.4%) in 2016 and 295/7,986 (3.7%) in 2024 (OR 1.02 per year, 95% CI 1.00-1.04; $p = 0.068$) (Table *2*).

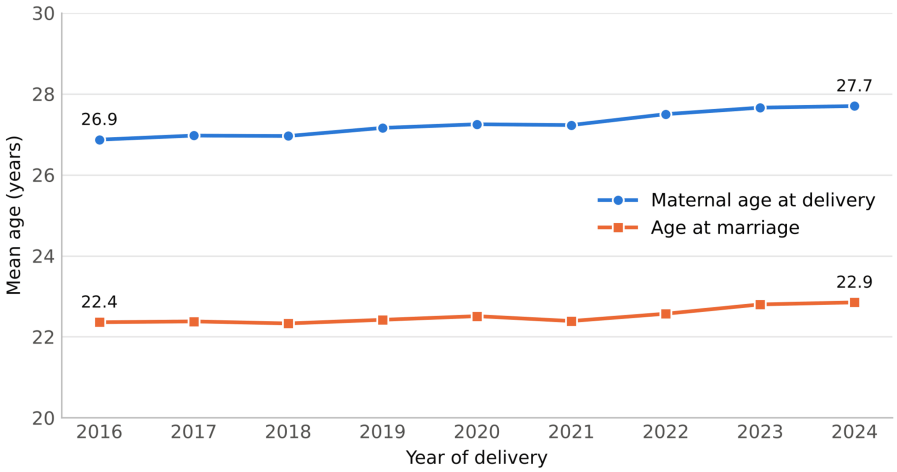


FIGURE 1: Mean maternal age at delivery and mean age at marriage by year of delivery, 2016–2024

Annual mean maternal age at delivery and mean age at marriage, 2016–2024. Labels show values for the first and last years. The y-axis starts at 20 years.

Measure	2016	2024	Trend per year (95% CI)	p
Maternal age, mean, years	26.87	27.7	+0.112 (0.096 to 0.128)	< 0.001
At 1st birth	24.53	25.12	+0.074 (0.052 to 0.097)	< 0.001
At 2nd birth	26.32	27.09	+0.074 (0.049 to 0.100)	< 0.001
At 3rd birth	28.63	29.39	+0.132 (0.101 to 0.163)	< 0.001
At 4th birth	30.18	31.28	+0.180 (0.136 to 0.223)	< 0.001
At ≥ 5th birth	32.33	33.06	+0.135 (0.076 to 0.194)	< 0.001
Maternal age < 20 y, %	137 (3.4)	295 (3.7)	OR 1.017 (0.999 – 1.036)	0.068
Maternal age ≥ 35 y, %	290 (7.2)	886 (11.1)	OR 1.079 (1.066 – 1.092)	< 0.001
Age at marriage, mean, years	22.36	22.85	+0.066 (0.053 to 0.080)	< 0.001
Married < 18 y, %	390 (9.9)	717 (9.4)	OR 0.995 (0.983 – 1.006)	0.343
Marriage-to-first-delivery interval, mean, years	1.52	1.65	+0.025 (0.013 to 0.036)	< 0.001
Nulliparous, %	1,430 (35.5)	2,771 (34.8)	OR 0.989 (0.982 – 0.996)	0.001
Parity, mean	1.25	1.3	+0.005 (0.001 to 0.009)	0.027
Parity ≥ 3, %	648 (16.1)	1,387 (17.4)	OR 1.010 (1.001 – 1.019)	0.025
Parity ≥ 5, %	97 (2.4)	167 (2.1)	OR 0.961 (0.940 – 0.982)	< 0.001

TABLE 2: Annual trends in baseline reproductive characteristics, 2016–2024

Linear regression (means) or logistic regression (proportions) on calendar year as a continuous term, fitted at record level; OR < 1 indicates a declining proportion. Birth order = parity + 1. After adjustment for maternal age group (< 20, 20–34, ≥ 35 years): nulliparous, p = 0.116; parity ≥ 3, p = 0.235; parity ≥ 5, adjusted OR 0.933, p < 0.001. CI: confidence interval; OR: odds ratio.

Trends in age at marriage

The mean age at marriage increased modestly, from 22.36 years in 2016 to 22.85 years in 2024 (0.07 years per year, 95% CI 0.05 to 0.08; p < 0.001) (Figure *1*). Because maternal age equals age at marriage plus duration of

marriage, about 0.5 years (59%) of the 0.8-year rise in mean maternal age across all deliveries corresponded to later marriage, with the remainder corresponding to a longer duration of marriage at delivery (Table 2).

The pattern was clearer among primigravida women, analyzed separately because each contributes a single record at her first pregnancy. Among 17,342/17,895 (96.9%) primigravidas with available marriage data, mean age at marriage rose from 23.01 years in 2016 to 23.47 years in 2024 (0.05 years per year, 95% CI 0.02 to 0.07; $p < 0.001$). The interval from marriage to delivery remained at about 1.4 years (1.37 years in 2016 and 1.44 years in 2024). Later marriage therefore corresponded to 0.46 years (86%) of the 0.53-year rise in mean maternal age in this group. The rise in age at marriage was slower among primigravida than among multigravida women (0.05 vs 0.08 years per year; $p = 0.027$ for the difference).

Marriage before 18 years did not decline. Among all deliveries, it was reported in 390/3,940 (9.9%) women in 2016 and 717/7,625 (9.4%) in 2024, with no significant trend across the study period (OR 0.995 per year, 95% CI 0.983-1.006; $p = 0.343$). Among primigravida women, it was also unchanged, at 90/1,206 (7.5%) in 2016 and 162/2,191 (7.4%) in 2024 ($p = 0.942$). About one in ten women delivering in 2024 had married before 18 years.

Among all nulliparous women, including those with a previous pregnancy loss, the interval from marriage to first delivery lengthened slightly, from 1.52 to 1.65 years (0.025 years per year, 95% CI 0.013 to 0.036; $p < 0.001$) (Table 2).

Nulliparous versus parous women

The proportion of nulliparous women was stable, at 1,430/4,027 (35.5%) in 2016 and 2,771/7,971 (34.8%) in 2024, with a low of 3,094/9,505 (32.6%) in 2022 (Figure 2). The small crude decline (OR 0.989 per year, 95% CI 0.982-0.996; $p = 0.001$) was not significant after adjustment for maternal age group ($p = 0.116$).

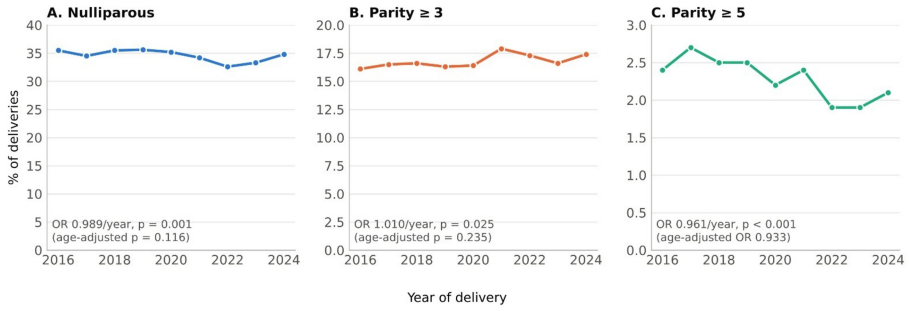


FIGURE 2: Proportion of deliveries by parity group and year of delivery, 2016–2024: (A) nulliparous, (B) parity ≥ 3 and (C) parity ≥ 5

Percentages use deliveries with known parity as the denominator. Each panel has its own y-axis scale. OR: odds ratio per calendar year from logistic regression.

Mean parity stayed close to 1.3 (1.25 in 2016, 1.30 in 2024). Parity ⩾ 3 rose slightly from 648/4,027 (16.1%) to 1,387/7,971 (17.4%) in the crude model (OR 1.010 per year, 95% CI 1.001-1.019; $p = 0.025$), but this was not significant after age adjustment ($p = 0.235$). Grand multiparity (parity ⩾ 5) was the only parity measure that declined, from 97/4,027 (2.4%) to 167/7,971 (2.1%) (OR 0.961 per year, 95% CI 0.940-0.982; $p < 0.001$), and the decline persisted after age adjustment (adjusted OR 0.933; $p < 0.001$) (Table 2).

Relationship between maternal age and birth order

Maternal age rose by roughly two years with each additional birth. Nulliparous women were the youngest group: in 2024, mean age was 25.1 years at first birth, 27.1 at second, 29.4 at third, 31.3 at fourth, and 33.1 at fifth or higher-order birth (Figure 3).

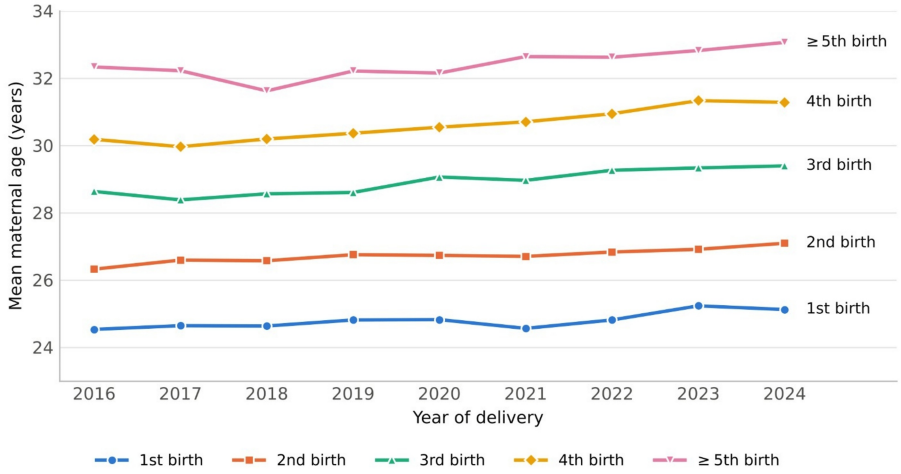


FIGURE 3: Mean maternal age at delivery by birth order and year of delivery, 2016–2024

Annual mean maternal age at delivery by birth order, 2016–2024. The y-axis starts at 23 years. Birth order = parity + 1; fifth and higher-order births are pooled. Numbers of deliveries: 1st, 21,170; 2nd, 17,662; 3rd, 12,332; 4th, 6,609; ≥ 5th, 3,769.

Maternal age increased within every birth order over the study period (all $p < 0.001$). The annual increase was smallest at first and second births (0.074 years per year each) and largest at fourth births (0.180 years per year), so the age gap between nulliparous and higher-parity mothers widened over time (Table *2*).

Changes in birth-order mix explained little of the overall aging. The annual increase in mean maternal age was 0.112 years (95% CI 0.096 to 0.128) unadjusted and 0.101 years (95% CI 0.087 to 0.114) after adjustment for birth order, so about 90% of the rise occurred within birth orders.

Discussion

This study describes nine years of reproductive patterns among women delivering at a hospital in Rawalpindi. Mean maternal age rose steadily, and the proportion of women aged 35 years or older increased by more than half. Most of the rise in mean maternal age corresponded to later marriage, and maternal age increased within every birth order. In contrast, marriage before 18 years did not decline; the share of first births stayed stable, and grand multiparity was the only parity group that fell.

Mean maternal age in our study rose from 26.9 to 27.7 years. This remains lower than in high-income countries, where mean maternal age at birth ranged from 28.8 years in the United States to 32.3 years in Spain in 2020 [10]. Mean age at first birth in our population was 25.1 years in 2024, compared with about 31 years in Italy and Spain [10]. Our population therefore shows the same direction of change, but is still at a much earlier stage. The proportion of deliveries to women aged 35 years or older rose from 290/4,029 (7.2%) in 2016 to 886/7,986 (11.1%) in 2024. By 2024, this was more than twice the 4.8% of women older than 35 years reported across seven population-based sites in the Global Network registry, which included rural Sindh [11]. In that registry, women older than 35 years had higher risks of perinatal mortality (adjusted relative risk [aRR] 1.58, 95% CI 1.49-1.67) and maternal mortality (aRR 2.55, 95% CI 1.81-3.59) than women aged 20-24 years [11]. A growing share of older mothers therefore means a growing high-risk group.

Teenage deliveries made up 2,061/61,592 (3.3%) of our sample. This is far lower than the 13.0% adolescent share in the Global Network sites [11]. It is closer to the 2.05% reported from a private urban hospital in Karachi between 2007 and 2016 [12]. This suggests that facility-based figures from urban hospitals differ considerably from those in rural, population-based settings.

Women in our study married at a mean age of 22.5 years. This is nearly three years later than the national mean of 19.7 years in 2017-18 [13]. Education is the strongest predictor of age at marriage in Pakistan, and higher education delays marriage by four to five years [13]. A similar pattern is seen in India, where education was the largest compositional contributor to the rise in age at first birth between 1992-93 and 2019-21 [14]. Mean age at marriage rose by about half a year during the study period, which corresponded to roughly 0.5 of the 0.8-year increase in maternal age. Nationally, the median age at first marriage rose by 1.8 years over almost three decades [6], so the pace we observed is broadly similar.

Marriage before 18 years remained at about 10% throughout the study period, at 390/3,940 (9.9%) in 2016 and 717/7,625 (9.4%) in 2024. Nationally, the proportion of married women who had married before 18 fell from 54% to 39% between 1990-91 and 2017-18 [8]. However, the national decline was largest among wealthy and urban households, and child marriage is now concentrated among poor, rural, and less educated women [8]. Women married as children in South Asia are less likely to receive antenatal care or to deliver with a skilled birth attendant [15], so they are less likely to appear in a hospital register.

The parity structure changed little. The share of first births stayed near one-third, and mean parity stayed close to 1.3. This fits national evidence that Pakistan's fertility transition is close to stalling, mainly because desired family size has remained high and unchanged [16]. The total fertility rate was still 3.6 in 2017-18 [6]. Grand multiparity accounted for 97/4,027 (2.4%) of deliveries in 2016 and 167/7,971 (2.1%) in 2024, similar to the 2.2% reported from a private urban hospital in Karachi in the early 1990s [17]. Grand multiparity was the only parity measure that declined, and the decline persisted after adjustment for age. This suggests that very large families are becoming less common, even though overall fertility remains high.

Maternal age rose by about two years with each additional birth. This is consistent with the median birth interval of 25 months reported in Karachi [18]. Our data are cross-sectional and do not measure birth intervals directly, so we could not identify women with very short intervals. Such intervals matter, as an interpregnancy interval shorter than six months is associated with preterm birth (OR 1.49, 95% CI 1.42-1.57) and low birth weight (OR 1.33, 95% CI 1.24-1.43) [19]. Maternal age also increased within every birth order. The rise was smallest at first and second births and largest at fourth births. Women at higher birth orders therefore showed the fastest increase in age, and they carry the combined risks of advanced age and high parity.

This study has several strengths. It used a large dataset of more than 61,000 deliveries, covered nine consecutive years, and reported annual trends rather than single time points. It also has limitations. It was conducted at a single hospital, so the findings may not apply to rural populations. Annual deliveries rose from 4,029 in 2016 to a peak of 9,509 in 2022, and changes in the catchment population may have influenced the trends. Age at marriage was calculated from the recorded duration of marriage and may be affected by recording errors. Women with more than one delivery contributed more than one record, which may have overstated the precision of our estimates and narrowed the confidence intervals; however, the separate analysis of primigravida women, who contribute one record each, showed a similar pattern. As a retrospective study, it can describe trends and associations but cannot establish causal relationships. Finally, socioeconomic variables such as education and income were not consistently recorded in the registry and could not be analyzed. Future studies should include these variables to explain the observed trends.

Conclusions

Among women delivering at this hospital, mean maternal age rose by almost one year over nine years, and the proportion aged 35 years or older rose by more than half. This rise largely paralleled later marriage, while family size changed little. About one in ten women had married before 18 years, with no decline over time. As these findings come from a single hospital, they may not apply to other populations. Hospitals in similar settings should plan antenatal care for a growing number of older mothers, and routine registry data can help monitor early marriage.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Supervision: Usman Zafar

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Review Board of Alkhidmat Raazi Hospital, Rawalpindi issued

approval IRB/AKRH/P08/26. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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