Consanguineous Marriages and Their Association With Women's Reproductive Health and Fertility Behavior in Pakistan: Secondary Data Analysis From Demographic and Health Surveys, 1990–2018

Sarosh Iqbal

University of the Punjab

Rubeena Zakar

University of the Punjab

Florian Fischer (✉ florian.fischer1@charite.de)

Charite Universitätsmedizin Berlin <https://orcid.org/0000-0002-4388-1245>

Muhammad Zakria Zakar

University of Okara

Research article

Keywords: Consanguinity, Consanguineous union, Reproduction, Sexual and reproductive health

Posted Date: October 1st, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-70736/v1>

License: This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published at BMC Women's Health on April 14th, 2022. See the published version at <https://doi.org/10.1186/s12905-022-01704-2>.

Abstract

Background: Pakistan has been showing consistently the highest prevalence of consanguinity. The popularity of consanguineous marriages is not declining in the country, because of social, cultural, and religious beliefs as well as economic advantages. However, couples also face various health related implications, such as poor pregnancy outcomes or multiple reproductive and fertility consequences, having adverse effects on mothers and their children. This research investigated the trend of consanguineous marriages and their association with women's reproductive health and fertility behavior in Pakistan from 1990 to 2018.

Methods: This study is based on a secondary data analysis, using all four waves of the Pakistan Demographic Health Surveys carried out during 1990 to 2018. The analysis is limited to women aged 15–49 years, who had given birth in the previous five years preceding each survey. Descriptive statistics, bivariable and multivariable logistic regression analysis was performed to determine the association of consanguinity with multiple characteristics related to socio-demographics, co-variables and women's reproductive health and fertility behaviors.

Results: The findings revealed a high but overall stable trend of consanguinity prevalence of about 63% during the last three decades. Consanguineous marriages were more prevalent amongst young and uneducated women, living in rural areas, with poorer wealth status and having less exposure of mass media to access information. A strong association of consanguinity was observed with women's reproductive health and fertility behavior, particularly for women who gave first birth at younger age, had multi-gravida pregnancies, multi-parity, pregnancy termination, ANC visits and higher fertility.

Conclusion: Consanguineous marriages are predominant in the patriarchal society of Pakistan. Findings revealed that consanguinity contributes significantly to women's reproductive health and fertility behaviors. Appropriate counselling, educational and health promotional programs related to consanguinity should be designed and launched at community level to raise awareness about risks towards women's reproductive health and fertility.

Background

Consanguinity is termed as a wedlock or marriage between close blood relations or biological kin. Consanguineous marriages have been very common since the early existence of humanity. According to a rough estimate, nearly one billion (20%) of the global population live in communities with a preference for consanguineous marriages [1, 2], predominantly in Muslim countries of the Middle East, Africa and South Asia [3, 4]. With 65%, Pakistan has one of the highest rates of cousin marriages globally, followed by India (55%), Saudi Arabia (50%), Afghanistan (40%), Iran (30%), Egypt and Turkey (20%) [5]. The prevalence of consanguineous unions differs amongst countries due to socio-demographic factors, such as geography (urban-rural residential community, isolated area and population), religion, education, socio-economic status, familial pattern towards early marriages or consanguinity between parents [4, 6–12]. Although the incidence of consanguineous unions somehow decreased with urbanization, modernization and smaller/nuclear families, however, it is still in practice [13].

Pakistan, a multi-cultural country with diverse caste systems, has been showing consistently the highest prevalence of consanguinity [14, 15]. Consanguineous marriages are encouraged in the country due to multiple reasons, e.g. to strengthen interfamily ties between close family members, a preference to the same caste and status, fear of incompatibility or difficulty in finding the right partner outside the family, security of being familiar with spouse and in-laws prior to marriage, restriction for socialization with opposite gender, and financial constraints especially for dowry [16]. However, various socio-cultural and health related implications have been identified for consanguineous

couples [5]. Owing to shared alleles, consanguinity may lead to genetic disorders [17, 18], poor pregnancy outcomes or multiple reproductive and fertility consequences, having adverse effects on mothers, their children, family and society as a whole [5, 13]. A strong association of consanguineous marriages has been reported with increased rates of abortion, still births, pregnancy terminations, low birth weights, increased mortality and congenital malformations [13, 17, 19–23]. Furthermore, a low preference for contraception, extended child bearing age and higher fertility has also been observed in such unions [8]. Although consanguineous marriages are also linked with poor pregnancy outcomes [22] and higher reproductive risks in Pakistan, nonetheless they are also associated with increased fertility rates and larger family size [24, 25].

Consanguineous unions have remained under continuous investigation of social scientists, medical researchers, biologists and physicians. However, it received less attention in mainstream demographic research. Although multiple studies are available regarding effects of consanguineous marriages on either reproductive health or fertility behaviors [22, 24, 25], nevertheless, there is a need to examine and explain the trends of consanguineous marriages and their association with women's reproductive health and fertility behavior in Pakistan. This research is an attempt to investigate the differentials in reproductive health and fertility behaviors over a period of almost three decades (1990–2018).

Methods

Study design and data source

This research performed a secondary data analysis, using all four waves of Pakistan Demographic and Health Surveys (PDHSs), carried out during 1990–91 (wave 1) [26], 2006–07 (wave 2) [27], 2012–13 (wave 3) [28], and 2017–18 (wave 4) [29]. These PDHSs are characterized as nationally representative and large-scale cross-sectional household surveys, conducted under the international series of MEASURE Demographic and Health Survey (DHS) Program and funded by the United States Agency for International Development (USAID). These surveys were carried out by the National Institute of Population Studies (NIPS) with technical assistance of ICF International and Pakistan Bureau of Statistics. A series of PDHSs is the largest household and publicly available dataset, with information on women's reproductive health, fertility behavior, marital status and other socio-demographic variables. Each PDHS applied a random two-stage cluster sampling design, wherein firstly rural and urban sampling units were chosen, followed by the selection of eligible households with ever-married women (aged 15–49 years) [26–29].

Within each wave of PDHS, varied numbers of field teams collected data, each comprised of one male and three female interviewers, field editor and supervisor. All teams were closely monitored by quality-controllers, provincial/regional field coordinators, as well as the NIPS and ICF core team. Simultaneously, data editing, processing and double data entry of completed questionnaires was also completed. Each wave of PDHSs used various questionnaires at household, community, women and men levels for data collection. This research used the standard female questionnaire for data analysis, administered to women (aged 15–49 years), using face-to-face method [26–29], and including questions about consanguinity, women's reproductive health and fertility behaviors. The response rate was recorded between 93% to 94.5% for each wave of PDHS [26–29].

This research limited analysis to the women of reproductive age (15–49 years), who had given birth in the previous years preceding each of the four PDHS waves during 1990 to 2018. Therefore, the sample size used for this study was 4,061, 5,677, 7,446, and 6,711, for 1990–91, 2006–07, 2012–13, and 2017–18, respectively.

Variables

Outcome variable:

The outcome variable for this research is marital status of respondents, i.e. non-consanguineous marriage vs. consanguineous marriage. Further, types of consanguineous marriages were divided into three categories, including married to paternal first cousins, married to maternal first cousins, and married to relatives other than first paternal or maternal cousins.

Reproductive health and fertility behavior:

Various variables related to women's reproductive health and fertility behavior were selected based on literature [1,5,8,13,19,21,22,25]. These included age at first birth (<20 years, 20–34 years, 35–49 years), gravidity (1–2, 3–5, 6 and above), parity (1–2, 3–4, 5 children and above), number of living children (none, 1–2, 3–4, 5 and above), ever terminated pregnancy (yes/no), antenatal care (ANC) visits during last pregnancy (less than 4 visits, 4 visits and above), skilled birth attendants (SBA) at delivery during the last pregnancy (yes/no), ideal family size (1–2, 3–4, 5 and above), fertility intention/desired family size (wants more children, wants no more, i.e. undecided, sterilized, declared infecund), and current use of contraception (yes/no).

Sociodemographic characteristics and co-variables:

The sociodemographic characteristics included geographical classification (urban, rural), regions/provinces (Islamabad, Sindh, Punjab, Khyber Pakhtunkhwa, FATA, Baluchistan, Gilgit Baltistan), respondent's age in years (15–24, 25–34, 35 years and above), education status (uneducated, primary, secondary, higher) as well as employment status of respondents and their husbands (unemployed, employed), and wealth quintile (richest, richer, middle, poorer, poorest). Other co-variables included exposure to mass media to access information (yes/no) and respondents' healthcare decision-making autonomy (yes/no).

Statistical analysis

Data analysis was conducted using SPSS version 21. Initially, sample weights were calculated and descriptive statistics were presented in the form of frequencies and percentages. For bivariate analyses, cross-tabulation and chi-square tests were applied. Afterwards, bivariable and multivariable logistic regression analyses were performed to measure the association of consanguineous marriages with sociodemographic characteristics, as well as women's reproductive health and fertility behaviors. During regression analysis, odds ratios (OR) and adjusted odds ratios (AOR) were calculated with 95% confidence interval (CI). A p-value ≤ 0.05 was considered statistically significant.

Results

Sample characteristics

Table 1 highlights respondents' socio-demographic characteristics and other co-variables for the four PDHS waves from 1990 to 2018. The majority of women were of 25–34 years of age, uneducated (but with a lower trend over time: 79.2%, 64.6%, 55.8%, and 47.9%), and resided in rural areas (70.9%, 69.8%, 59.9%, and 66.5%). About three quarter or even more of the women were unemployed. Contrary to respondents, most of their husbands acquired secondary level of education and almost all of them were employed. Although, findings revealed that about 60–70% of women had exposure to mass media, about half of the participants had no autonomy in healthcare decision making.

Trend of consanguineous marriages

Table 2 shows the proportion of consanguineous marriages amongst women of reproductive age from 1990 to 2018. Results indicate that about two thirds of women were married to their cousins, more frequently with paternal first cousin than maternal. Findings revealed an overall stable proportion of consanguinity prevalence during last three decades. However, even a slightly upward trend of consanguineous marriages was witnessed from 63.0% in 1990–91 to 67.9% in 2007–08, followed by a gradual downwards trend. Similarly, the pattern of marriages with paternal and maternal first cousins decreased during the period from 1990 to 2013, nonetheless, slightly increased in 2017–18.

Reproductive health and fertility behavior related characteristics

Table 2 demonstrates the characteristics related to women's reproductive health and fertility behavior during 1990 to 2018. Results indicated that the majority of respondents gave their first birth at an age below 20 years and had multi-gravida pregnancies between 3–5 times (44.5%, 43.3%, 43.4%, and 44.8%). Parity of 5 children and more decreased over time (41.2%, 35.7%, 31.1%, and 26.5%). The proportion of deliveries conducted by unskilled birth attendants during the last pregnancy constantly decreased from 81.5% in 1990–91 to 28.0% in 2017–18. Findings also revealed the gradual improvement in women's reproductive healthcare seeking behaviors, particularly in availing at least 4 ANC visits and deliveries conducted by SBAs during 1990 to 2018. Furthermore, regarding women's fertility behavior, the analysis indicated that most of the women (68.8%) reported an ideal family size of 5 children and above in 1990, which decreased over time to 3–4 children in 2017–18 (51.8%). Although about half of the respondents showed no more desire for children or fertility intention in all four waves, there was a high – but overall decreasing – rate of not using contraception (88.3%, 70.6%, 62.7%, and 63.9%).

Bivariate association of consanguinity with various factors

The association of consanguineous marriages with various factors – including sociodemographic characteristics, and reproductive health and fertility behaviors – amongst respondents of reproductive age in each of the four PDHS waves is presented in Table 3. Findings demonstrate the significant relationship of consanguinity with regions/provinces, urban/rural geographical classification, respondents' education, wealth quintile, mass media exposure and healthcare decision-making autonomy in all waves. Respondents' age, employment status and their husbands' educational status was also found statistically significant in most of the PDHS waves. Furthermore, results highlight the significant relationship of consanguinity with respondents' age at first birth, ANC visits, deliveries by SBAs, ideal family size, fertility intention and current use of contraception in the majority of PDHS waves. In a few PDHS waves, a strong association of consanguineous unions was also observed with the number of living children, gravidity, and pregnancy termination.

Bivariable and multivariable logistic regression

Table 4 depicts the results of the bivariable logistic regression analysis of consanguinity with respondents' sociodemographic characteristics, reproductive health and fertility behaviors. Almost all sociodemographic variables in the four PDHS waves were significantly associated with consanguinity – at least one category per item. However, husband's employment status was only significant for 2017–18. Furthermore, gravidity and parity, and number of children showed nearly no significant associations.

When interpreting the results of the multivariable logistic regression analysis (Table 5), one needs to keep in mind that not all variables and categories have been assessed in all four waves. However, the results highlight that

respondent's age was not significantly associated with consanguinity. The region and geographical classification were significant predictors of consanguinity, except for 2017–18. The impact of education was contrary between women and their husband: Women with higher education had a lower likelihood for consanguineous marriages, whereas men with higher education were more likely to marry their relatives. The strength of the association for both variables reduced over time. Employment status both for women and their husband showed inconclusive results – the only significant association was found for employed women showing a higher likelihood of consanguinity in 2012–13 (AOR=1.23, 95% CI: 1.08–1.39, $p<0.01$).

In 1990–91, the wealth index was not significantly associated with consanguinity, but for all other waves a higher wealth quintile was linked with lower likelihood of consanguineous marriages. For example, in 2012–13 (AOR=0.53, 95% CI: 0.41–0.69, $p<0.01$) and 2017–18 (AOR=0.47, 95% CI: 0.35–0.62, $p<0.01$) the likelihood was halved in the richest wealth quintile compared to the poorest one. There was no impact of mass media exposure and respondent's healthcare decision-making autonomy, except for 2012–13, where women having decision-making autonomy were less likely to be married with relatives (AOR=0.83, 95% CI: 0.74–0.92, $p<0.01$).

As already shown in the bivariable logistic regression models, respondent's age at first birth, gravidity and parity, and number of children showed almost no or only in some years or categories significant associations. Nevertheless, there is a trend younger age at first birth and lower gravidity is linked with consanguineous marriages. In 1990–91 and 2006–07, a lower number of children was associated with a higher likelihood for consanguineous marriages, ever having terminated a pregnancy was only significantly associated with a higher likelihood for consanguinity in 2012–13 (AOR=1.29, 95% CI: 1.15–1.44, $p<0.01$). Visits of ANC and deliveries by SBAs were also no significant predictors, except for single exceptions. However, an ideal family size of less than five children was almost entirely significantly associated with not marrying a relative. The use of contraceptive was not significantly associated with consanguineous marriages.

Discussion

With the advanced research and expansion of knowledge in public health and social sciences, the topic of consanguineous unions has received higher importance. From the beginning of mankind, consanguinity or close-kin marriages was socially and culturally deeply rooted. Although it is presumed that the rates of consanguineous marriages decline with modernization and literacy, this is not transferable to all countries [30]. Presently, consanguinity is widely popular and respected in many communities, particularly in Muslims [2, 3]. Pakistan ranks amongst those countries, where the highest prevalence of consanguinity is still in vogue [3, 22, 25]. This article examined the trends of consanguineous marriages over the period of approximately three decades, from 1990 to 2018, and their association with women's reproductive health and fertility behavior in Pakistan. It is an effort to bridge the gap in existing literature, documenting the relevance of consanguinity with reproductive health and fertility behavior amongst women, who had given births in five years preceding each of the four PDHS waves.

The results showed a varied trend of consanguineous marriages in Pakistan, which increased from 63.0% in 1990–91 to 67.9% in 2006–07, however, declined to 66.2% during 2012–13 and 63.6% in 2018. This highlights the fact that popularity of consanguineous unions is not declining in the country, because of social, cultural, religious and economic advantages, which out-weigh the disadvantages in view of the population [31]. In particular, consanguinity promotes family stability, inheritance and spouse compatibility, nonetheless lessens hidden financial risks [6, 7, 16, 32]. These results are similar to other studies, carried out in many subpopulations within Pakistan [33], such as northern Punjab [34, 35], southern Khyber Pakhtunkhwa [36], Balochistan [37], Kashmir [38], and also in other Arab

countries [1, 39], Yemen [40], Qatar [41] and Algeria [42]. Contrary, these results are not consistent to some of the research, where a decreasing trend in consanguineous unions was reported over time [43, 44].

This research also reiterated that consanguinity is associated with sociodemographic characteristics, as results demonstrated that consanguineous marriages are more prevalent amongst uneducated women, living in rural areas, and with poorer wealth status. These findings are comparable to other studies, where less educated women get married with cousins at younger age, particularly in poor traditional rural areas [10, 45–48]. This highlights the need to educate and empower young girls, enabling them to make better decisions in life to ensure their well-being.

Previous empirical results found a strong association of consanguineous unions with women's reproductive health and fertility behaviors. Findings demonstrated that those women who married to their cousins were more likely to give first birth at younger age (between 20–34 years). Although not entirely significant in our analysis, we can also confirm this result. Our findings correspond to the previous studies, showing that consanguinity is associated with higher fertility rates and larger family sizes, which affects the health of both mothers and children [5, 8, 13, 22, 24, 25]. Thus, there is a need to educate communities about linkages of consanguinity with poor reproductive health, adverse impact on fertility outcomes and overall family health. This research emphasizes to educate families regarding implications of consanguinity and associated health risks, through increasing public awareness, providing informational material, promoting health education and enhancing capacities of primary healthcare and outreach workers to counsel communities effectively on health and social issues related to consanguineous marriages. It is pertinent to actively engage all key stakeholders at public and private sector to promote healthy mothers, children and communities.

Limitations

Since this research analyzed the four waves of PDHS from 1990 to 2018, few variables were not uniform and found missing, particularly in PDHS 1990–91 and 2006–07, such as regions/provinces, mass media exposure, respondent's healthcare decision-making autonomy and pregnancy termination. Due to the cross-sectional design, we are not able to draw any causal conclusions. When interpreting the results, one need to consider that some of the variables might be predictors of consanguineous marriages (such as low education), whereas others are effects (such as visits of ANC and deliveries by SBAs) or both (such as ideal family size).

Conclusion

This research concludes that consanguineous marriages are predominant in Pakistan, particularly in the context of the large power structure and patriarchal society. Findings revealed that consanguinity is associated with sociodemographic characteristics and women's reproductive health and fertility behaviors in Pakistan. The high prevalence of consanguineous marriages and their implications on women's health is essential to be considered in health policies. There is also a dire need to actively engage public health and reproductive health professionals to promote health and wellbeing of the female population. Appropriate counselling, health educational and promotional programmes related to consanguinity should be designed and launched at community level to raise awareness. Though there are multiple socio-cultural and economic benefits of consanguinity perceived by women in Pakistan, improvements in health literacy and behavior change will endorse attitudinal change in society.

Abbreviations

ANC Antenatal care

AOR Adjusted odds ratio

CI Confidence interval

OR Odds ratio

PDHS Pakistan Demographic and Health Survey

SBA Skilled birth attendant

SPSS Statistical Package for the Social Sciences

Declarations

Ethical Approval and Consent to Participate

This study is based on a secondary data analysis. Therefore, not ethical approval is required. All participants provided written informed consent before data collection.

Consent for Publication

Not applicable.

Availability of Data and Materials

Data is available from the Demographic and Health Survey program: <https://dhsprogram.com/>

Competing Interest

The authors declare that no competing interest exist. FF serves on the Editorial Board of BMC Women's Health as Associate Editor.

Funding

This research received no supporting funds from any funding agency in the public, commercial, or not-for-profit sector.

Authors Contributions

The study was conceptualized by SI and RZ. SI analysed the data, RZ and MZZ supervised data analysis. SI drafted the manuscript; RZ, FF and MZZ revised it critically for important intellectual content. All authors reviewed the final version of the manuscript.

Acknowledgements

We acknowledge support from the German Research Foundation (DFG) and the Open Access Publication Fund of Charité – Universitätsmedizin Berlin.

References

1. Tadmouri GO, Nair P, Obeid T, Al Ali TM, Al Khaja N, Hamamy HA. Consanguinity and reproductive health among Arabs. *Reprod Health*. 2009;6:17.
2. Bittles AH. **The global prevalence of consanguinity**. 2015.
http://www.consang.net/index.php/Global_prevalence. **Accessed January 31, 2020**.
3. Riaz HF, Mannan S, Malik S. Consanguinity and its socio-biological parameters in Rahim Yar Khan District, Southern Punjab, Pakistan. *J Health Popul Nutr*. 2016;35:14.
4. Bittles AH, Black ML. Evolution in health and medicine Sackler colloquium: Consanguinity, human evolution, and complex diseases. *Proc Natl Acad Sc USA*. 2010;107(Suppl 1):1779–86.
5. Olubunmia O, Nevesb K, Badreldeenc A, Konjea JC. A review of the reproductive consequences of consanguinity. *Eur J Obstet Gynecol Reprod Biol*. 2019;232:87–96.
6. Teebi AS, Teebi SA, Porter CJ, Cuticchia AJ. Arab Genetic Disease Database (AGDDB): A population-specific clinical and mutation database. *Hum Mutat*. 2002;19(6):615–21.
7. Anwar WA, Khyatti M, Hemminki K. Consanguinity and genetic diseases in North Africa and immigrants to Europe. *Eur J Public Health*. 2014;24(Suppl. 1):57–63.
8. Bittles AH, Grant J, Sullivan SG, Hussain R. Does inbreeding lead to decreased human fertility? *Ann Hum Biol*. 2002;29(2):111–30.
9. Hamamy H, Jamhawi L, Al-Darawsheh J, Ajlouni K. Consanguineous marriages in Jordan: why is the rate changing with time? *Clin Genet*. 2005;67(6):511–6.
10. Bener A, Abdulrazzaq YM, Al-Gazali LI, Micallef R, Al-Khayat AI, Gaber T. Consanguinity and associated socio-demographic factors in the United. **Arab Emirates** *Hum Hered*. 1996;46(5):256–64.
11. Sureender S, Prabakaran B, Khan AG. Mate selection and its impact on female marriage age, pregnancy wastages, and first child survival in Tamil Nadu, India. *Soc Biol*. 1998;45(3–4):289–301.
12. Jaber L, Bailey-Wilson JE, Haj-Yehia M, Hernandez J, Shohat M. Consanguineous matings in an Israeli-Arab community. *Arch Pediatr Adolesc Med*. 1994;148(4):412–5.
13. Metgud CS, Naik VA, Mallapur MD. Consanguinity and pregnancy outcome among rural pregnant women of Belgaum district. *Nat J Commun Med*. 2012;3(4):681–4.
14. Agha N. Kinship in rural Pakistan: Consanguineous marriages and their implications for women. *Women's Studies International Forum*. 2016;54:1–10.
15. Jones GW. Changing marriage patterns in Asia. Asia Research Institute Working Paper Series No 131. Asia Research Institute and Department of Sociology. National University of Singapore; 2010.
16. Qidwai W, Syed IA, Khan FM. Prevalence and perceptions about consanguineous marriages among patients presenting to family physicians, in 2001 at a Teaching Hospital in Karachi, Pakistan. *Asia Pacific Family Medicine*. 2003;2(1):27–31.
17. Devi ACP, Sudarsanam D. Role of Consanguinity in Mental Retardation. *Asian J Exp Biol Sci*. 2011;2:162–4.
18. McKusick V. *Human Genetics*. 2nd ed. New Delhi: Prentice Hall of India; 1972.
19. Zakar R, Zakar MZ, Aqil N. Adverse birth outcomes associated with consanguineous marriage in Pakistan. *Int J Gynecology Obstet*. 2014;127(2):211–2.
20. Hasnain SF, Hashmi SK. Consanguinity among the risk factors for underweight in children under five: A study from rural Sindh. *Journal of Ayub Medical College Abbottabad*. 2009;21(3):111–6.
21. Ullah MA, Husseni AM, Mahmood SU. Consanguineous marriages and their detrimental outcomes in Pakistan: An urgent need for appropriate measures. *International Journal of Community Medicine Public Health*.

2018;5(1):1–3.

22. Omer S, Farooq S, Jabeen S. Effects of cousin marriages on adverse pregnancy outcomes among women in Pakistan: A secondary analysis of data from the Pakistan Demographic and Health Survey 2012-13. *Pakistan Journal of Women's Studies*. 2016;23(1):65–76.
23. RoyChoudhary AK. Incidence of in-breeding in different States of India. *Demography India*. 1976;5:108–15.
24. Shami SA, Schmitt LH, Bittles AH. Consanguinity, spousal age at marriage and fertility in seven Pakistani Punjab cities. *Ann Hum Biol*. 1990;17(2):97–105.
25. Manzoor R, Imran W, Maken AM, Syed TH. Consanguineous marriages: Effects on pregnancy outcomes in Pakistan. *Journal of Development Policy Research Practice*. 2018;2:1.
26. National Institute of Population Studies (NIPS). *Pakistan Demographic and Health Survey (PDHS) 1990–91*. Maryland: Macro International Inc.; 1991.
27. National Institute of Population Studies (NIPS). *Pakistan Demographic and Health Survey (PDHS) 2006–07*. Maryland: Macro International Inc.; 2007.
28. National Institute of Population Studies (NIPS). *Pakistan Demographic and Health Survey (PDHS) 2012–13*. Maryland: Macro International Inc.; 2013.
29. National Institute of Population Studies (NIPS). *Pakistan Demographic and Health Survey (PDHS) 2017–18*. Maryland: Macro International Inc.; 2018.
30. Baykara-Krumme H. Consanguineous marriage in Turkish families in Turkey and in Western Europe. *Int Migration Rev*. 2018;50(3):568–98.
31. Jaber L, Halpern GJ, Shohat M. The impact of consanguinity worldwide. *Community Genet*. 1998;1:12–7.
32. Bittles AH. Endogamy, consanguinity and community genetics. *J Genet*. 2002;81(3):91–8.
33. Hussain R, Bittles AH. The prevalence and demographic characteristics of consanguineous marriages in Pakistan. *J Biosoc Sci*. 1998;30(2):261–75.
34. Shami SA, Grant JC, Bittles AH. Consanguineous marriages within social/occupational class boundaries in Pakistan. *J Biosoc Sci*. 1994;26(1):91–6.
35. Hina S, Malik S. Pattern of consanguinity and inbreeding coefficient in Sargodha district, Punjab, Pakistan. *J Biosoc Sci*. 2015;47(6):803–11.
36. Wahab A, Ahmad M. Biosocial perspectives of consanguineous marriages in rural and urban Swat, Pakistan. *J Biosoc Sci*. 1996;28(3):305–13.
37. Maian A, Mushtaq R. Consanguinity in population of Quetta (Pakistan): A preliminary study. *Geography*. 1994;5:49–53.
38. Jabeen N, Malik S. Consanguinity and its socio-demographic differentials in district Bhimber, Azad Jammu Kashmir, Pakistan. *J Health Popul Nutr*. 2014;32(2):301–13.
39. Al-Gazali LI, Bener A, Abdulrazzaq YM, Micallef R, Al-Khayat AI, Gaber T. Consanguineous marriages in the United Arab Emirates. *J Biosoc Sci*. 1997;29(4):491–7.
40. Jurdi R, Saxena PC. The prevalence and correlates of consanguineous marriages in Yemen: Similarities and contrasts with other Arab countries. *J Biosoc Sci*. 2003;35(1):1–13.
41. Bener A, Alali KA. Consanguineous marriage in a newly developed country: The Qatari population. *J Biosoc Sci*. 2006;38(2):239–46.
42. Zaoui S, Biemont C. Frequency of consanguineous unions in the Tlemcen area (West Algeria). *Sante*. 2002;12(3):289–95.

43. Nath A, Patil C, Naik VA. Prevalence of consanguineous marriages in a rural community and its effect on pregnancy outcome. *Indian Journal of Community Medicine*. 2004;29(1):41–3.
44. Godhi SA, Metgud CS, Mallapur MD. Prevalence of consanguineous marriage and its effect on pregnancy outcome in a rural area. *Journal of Scientific Society*. 2009;36:93–5.
45. Bittles AH. The role and significance of consanguinity as a demographic variable. *Popul Dev Rev*. 1994;20(3):561–84.
46. Shah NM. Women's socioeconomic characteristics and marital patterns in a rapidly developing muslim society, Kuwait. *Journal of Comparative Family Studies*. 2004;35(2):163–83.
47. Weinreb AA. Characteristics of women in consanguineous marriages in Egypt, 1988–2000. *European Journal of Population*. 2008;24(2):185–210.
48. Koc I. Prevalence and socio-demographic correlates of consanguineous marriages in Turkey. *J Biosoc Sci*. 2008;40(1):137–48.

Tables

Table 1
Sociodemographic characteristics and co-variables of respondents

Characteristics	PDHS (1990–91)		PDHS (2006–07)		PDHS (2012–13)		PDHS (2017–18)	
	n = 4,061		n = 5,677		n = 7,446		n = 6,711	
	f	%	f	%	f	%	f	%
Sociodemographic characteristics								
Regions/Provinces								
Punjab	2,441	60.1	3,182	56.1	4,180	56.1	3,453	51.5
Sindh	894	22	1,404	24.7	1,714	23	1,571	23.4
Baluchistan	159	3.9	264	4.6	348	15	377	5.6
Khyber Pakhtunkhwa ^a	567	14	827	14.6	1,117	4.7	1,101	16.4
Gilgit Baltistan*	–	–	–	–	56	0.7	–	–
Islamabad*	–	–	–	–	31	0.4	54	0.8
FATA*	–	–	–	–	–	–	156	2.3
Geographical classification								
Urban	1,184	29.1	1,714	30.2	2,244	30.1	2,248	33.5
Rural	2,877	70.9	3,962	69.8	5,202	69.9	4,463	66.5
Respondents' age								
15–24 years	983	24.2	1,334	23.5	1,748	23.5	1,545	23
25–34 years	2,061	50.7	2,952	52.0	4,038	54.2	3,725	55.5
35 years and above	1,017	25	1,390	24.5	1,659	22.3	1,440	21.5

^a Khyber Pakhtunkhwa was formerly known as North-West Frontier Province (NWFP), as previously reported in PDHS 1990–91 and 2006–07.

^b Mass media exposure refers to the frequency of reading a newspaper or watching TV or listening to radio

* Missing information indicates the non-availability of data within the respective PDHS wave.

Characteristics	PDHS (1990–91)		PDHS (2006–07)		PDHS (2012–13)		PDHS (2017–18)	
	n = 4,061		n = 5,677		n = 7,446		n = 6,711	
	f	%	f	%	f	%	f	%
Respondents' education status								
Uneducated	3,214	79.2	3,668	64.6	4,155	55.8	3,212	47.9
Primary	373	9.2	854	15.0	1,230	16.5	1,097	16.3
Secondary	427	10.5	813	14.3	1,380	18.5	1,492	22.2
Higher	47	1.2	341	6.0	682	9.2	911	13.6
Husbands' education status								
Uneducated	1,946	48.2	2,007	35.4	2,451	33	1,889	28.7
Primary	698	17.3	935	16.5	1,211	16.3	1,085	16.5
Secondary	1,213	30	1,904	33.5	2,547	34.3	2,316	35.2
Higher	181	4.5	812	14.3	1,216	16.4	1,293	19.6
Respondents' employment status								
Unemployed	3,389	83.5	4,026	71.0	5,378	72.2	5,528	82.4
Employed	669	16.5	1,647	29.0	2,068	27.8	1,180	17.6
Husbands' employment status								
Unemployed	77	2	174	3.1	123	1.7	173	2.6
Employed	3,844	98	5,501	96.9	7,322	98.3	6,415	97.4
Wealth quintile								
Richest	1,085	26.7	1,029	18.1	1,272	17.1	1,248	18.6
Richer	923	22.7	1,066	18.8	1,469	19.7	1,349	20.1
Middle	755	18.6	1,099	19.4	1,464	19.7	1,371	20.4
Poorer	689	17	1,194	21.0	1,544	20.7	1,299	19.4
Poorest	609	15	1,289	22.7	1,698	22.8	1,444	21.5
Covariates								
Mass media exposure ^{a,b}								
Yes	1,636	59.5	–	–	5,241	70.6	4,254	63.4

^a Khyber Pakhtunkhwa was formerly known as North-West Frontier Province (NWFP), as previously reported in PDHS 1990–91 and 2006–07.

^b Mass media exposure refers to the frequency of reading a newspaper or watching TV or listening to radio

* Missing information indicates the non-availability of data within the respective PDHS wave.

Characteristics	PDHS (1990–91)		PDHS (2006–07)		PDHS (2012–13)		PDHS (2017–18)	
	n = 4,061		n = 5,677		n = 7,446		n = 6,711	
	f	%	f	%	f	%	f	%
No	2,404	40.5	–	–	2,184	29.4	2,454	36.6
Respondents' healthcare decision-making autonomy*								
Yes	–	–	–	–	3,511	47.9	3,054	46.2
No	–	–	–	–	3,826	52.1	3,550	53.8
^a Khyber Pakhtunkhwa was formerly known as North-West Frontier Province (NWFP), as previously reported in PDHS 1990–91 and 2006–07.								
^b Mass media exposure refers to the frequency of reading a newspaper or watching TV or listening to radio								
* Missing information indicates the non-availability of data within the respective PDHS wave.								

Table 2
Measures to describe consanguinity, reproductive health and fertility behavior

Characteristics	PDHS (1990–91)		PDHS (2006–07)		PDHS (2012–13)		PDHS (2017–18)	
	n = 4,061		n = 5,677		n = 7,446		n = 6,711	
	f	%	f	%	f	%	f	%
Consanguinity								
Marital status								
Non-consanguineous marriages	1,500	37	1,819	32.1	2,519	33.8	2,440	36.4
Consanguineous marriages	2,550	63	3,855	67.9	4,926	66.2	4,270	63.6
Type of consanguineous marriages								
Married to paternal first cousins	1,223	47.9	1,814	47.1	2,061	41.9	1,882	44.1
Married to maternal first cousins	856	33.6	1,198	31.1	1,558	31.7	1,433	33.6
Married to relatives other than first paternal/maternal cousins	471	18.5	842	21.8	1,300	26.4	953	22.3
Reproductive health and fertility behavior								
Age at first birth								
< 20 years	2,390	58.8	3,072	54.1	3,685	49.5	3,076	45.8
20–34 years	1,648	40.6	2,588	45.6	3,733	50.1	3,593	53.5
35–49 years	23	0.6	17	0.3	28	0.4	42	0.6
Gravidity								
1–2	1,306	32.2	2,071	36.5	2,980	40	2,829	42.2
3–5	1,808	44.5	2,456	43.3	3,233	43.4	3,009	44.8
6 and above	947	23.3	1,150	20.3	1,233	16.6	873	13
Parity								
1–2 children	1,245	30.7	2,000	35.2	2,885	38.7	2,749	41
3–4 children	1,142	28.1	1,648	29	2,249	30.2	2,183	32.5
5 children and above	1,674	41.2	2,029	35.7	2,312	31.1	1,780	26.5
Number of living children								
None	71	1.7	100	1.8	80	1.1	83	1.2
1–2	1,360	33.5	2,138	37.7	3,149	42.3	2,944	43.9
3–4	1,294	31.9	1,737	30.6	2,306	31.0	2,222	33.1
5 and above	1,336	32.9	1,702	30.0	1,912	25.7	1,463	21.8
* Missing information indicates the non-availability of data within the respective PDHS wave.								

Characteristics	PDHS (1990–91)		PDHS (2006–07)		PDHS (2012–13)		PDHS (2017–18)	
	n = 4,061		n = 5,677		n = 7,446		n = 6,711	
	f	%	f	%	f	%	f	%
Ever terminated pregnancy*								
Yes	–	–	1,352	23.8	2,512	33.7	2,166	32.3
No	–	–	4,320	76.2	4,935	66.3	4,545	67.7
Visits for antenatal care								
Less than 4 visits	3410	85.8	3987	71.2	4713	63.4	2,414	41.1
At least 4 visits or more	564	14.2	1611	28.8	2723	36.6	3,452	58.9
Deliveries by skilled birth attendants								
Yes	743	18.5	2365	41.9	4112	55.2	4,833	72
No	3285	81.5	3280	58.1	3312	44.5	1,879	28
Ideal family size								
1–2	219	5.4	735	12.9	1,055	14.2	1,174	17.5
3–4	1,045	25.8	3,032	53.4	4,200	56.4	3,479	51.8
5 and above	2,791	68.8	1,910	33.6	2,191	29.4	2,059	30.7
Desire for more children / Fertility intention								
Wants more children	1,748	43.7	2,647	46.7	3,592	49	3,115	47.2
Wants no more	2,254	56.3	3,023	53.3	3,745	51	3,480	52.8
Current use of contraception								
Yes	475	11.7	1,670	29.4	2,774	37.3	2,421	36.1
No	3,586	88.3	4,007	70.6	4,672	62.7	4,290	63.9
* Missing information indicates the non-availability of data within the respective PDHS wave.								

Table 3

Relationship of consanguinity with sociodemographic characteristics, reproductive health and fertility behavior

Relationship of consanguinity with sociodemographic characteristics, reproductive health and fertility behavior												
Characteristics	PDHS (1990–91)			PDHS (2006–07)			PDHS (2012–13)			PDHS (2017–18)		
	n = 4,061			n = 5,677			n = 7,446			n = 6,711		
	Consanguineous	Non-consanguineous	p-value*	Consanguineous	Non-consanguineous	p-value*	Consanguineous	Non-consanguineous	p-value*	Consanguineous	Non-consanguineous	p-value*
Sociodemographic characteristics and co-variables												
Regions/Provinces												
Punjab	65.6	34.4	< 0.01	68.4	31.6	< 0.01	65.6	34.4	< 0.01	60	40	< 0.01
Sindh	61.6	38.4		73.0	27.0		71.4	28.6		73.8	26.2	
Baluchistan	70.3	29.7		72.3	27.7		69.7	30.3		64.7	35.3	
Khyber Pakhtunkhwa	51.9	48.1		56.1	43.9		60.3	39.7		61.7	38.3	
Gilgit Baltistan	–	–		–	–		51.8	48.2		–	–	
Islamabad	–	–		–	–		58.1	41.9		55.6	44.4	
FATA	–	–		–	–		–	–		56.4	43.6	
Geographical classification												
Urban	53.1	46.9	< 0.01	60.0	40.0	< 0.01	54.8	45.2	0.00	58.6	41.4	< 0.01
Rural	67.0	33.0		71.4	28.6		71.1	28.9		66.2	33.8	
Respondents' age												
15–24 years	67.3	32.7	< 0.01	70.1	29.9	0.12	70.4	29.6	< 0.01	68.8	31.2	< 0.01
25–34 years	62.4	37.6		66.9	33.1		64.8	35.2		62.1	37.9	
35 years and above	59.8	40.2		68.1	31.9		65.0	35.0		62.0	38.0	
Respondents' education status												
Uneducated	65.0	35.0	< 0.01	70.5	29.5	< 0.01	71.4	28.6	< 0.01	69	31.0	< 0.01
Primary	64.8	35.2		67.5	32.5		66.8	33.2		65.3	34.7	
Secondary	48.2	51.8		62.3	37.7		58.2	41.8		59.7	40.3	
Higher	41.3	58.7		55.0	45.0		49.2	50.8		49.1	50.9	
Husbands' education status												
Uneducated	61.1	38.9	< 0.01	68.7	31.3	0.45	67.6	32.4	< 0.01	66.8	33.2	< 0.01
Primary	68.9	31.1		69.2	30.8		69.8	30.2		69.6	30.4	
Secondary	63.5	36.5		67.2	32.8		65.4	34.6		62.7	37.3	
Higher	54.7	45.3		66.3	33.7		61.6	38.4		57.2	42.8	
Respondents' employment status												
Unemployed	62.2	37.8	0.03	66.2	33.8	< 0.01	63.1	36.9	< 0.01	63.3	36.7	0.18
Employed	66.8	33.2		72.3	27.7		74.1	25.9		65.3	34.7	
Husbands' employment status												
Unemployed	66.7	33.3	0.47	68.4	31.6	0.89	70.7	29.3	0.28	71.5	28.5	0.03
Employed	62.7	37.3		67.9	32.1		66.1	33.9		63.7	36.3	
Mass media exposure												
Yes	59.0	41.0	< 0.01	–	–	–	64.0	36	< 0.01	61.6	38.4	< 0.01
No	66.0	34.0		–	–		71.4	28.6		67.1	32.9	
Wealth quintile												
Richest	59.9	40.1	< 0.01	61.3	38.7	< 0.01	54.7	45.3	< 0.01	51.4	48.6	< 0.01
Richer	60.1	39.9		62.7	37.3		56.6	43.4		58.8	41.2	
Middle	61.1	38.9		66.2	33.8		66.1	33.9		65.9	34.1	
Poorer	69.8	30.2		69.8	30.2		71.5	28.5		65.4	34.6	
Poorest	67.1	32.9		77.3	22.7		78.3	21.7		74.9	25.1	
Respondent's healthcare decision-making autonomy												
Yes	–	–	–	–	–	–	63.2	36.8	< 0.01	62.6	37.4	0.04
No	–	–		–	–		69.2	30.8		65.1	34.9	
Reproductive health and fertility behaviors												
Respondent's age at first birth												
< 20 years	63.9	36.1	0.32	69.5	30.5	0.00	71.3	28.7	0.00	68.0	32.0	0.00
20–34 years	61.8	38.2		66.3	33.7		61.1	38.9		60.1	39.9	
35–49 years	56.5	43.5		47.1	52.9		64.3	35.7		48.8	51.2	
Gravidity												
1–2	66.6	33.4	0.00	68.8	31.2	0.58	65.9	34.1	0.65	63.9	36.1	0.78
3–5	62.0	38.0		67.4	32.6		66.0	34.0		63.2	36.8	

Characteristics	PDHS (1990–91)			PDHS (2006–07)			PDHS (2012–13)			PDHS (2017–18)		
	n = 4,061			n = 5,677			n = 7,446			n = 6,711		
	Consan- guineous	Non- consan- guineous	p- value*	Consan- guineous	Non- consan- guineous	p- value*	Consan- guineous	Non- consan- guineous	p- value*	Consan- guineous	Non- consan- guineous	p- value*
6 and above	59.7	40.3		67.7	32.3		67.3	32.7		64.1	35.9	
Parity												
1–2 children	65.3	34.7	0.12	67.7	32.3	0.14	64.7	35.3	0.08	63.8	36.2	0.52
3–4 children	61.8	38.2		66.4	33.6		66.5	33.5		62.8	37.2	
5 children and above	62.1	37.9		69.4	30.6		67.7	32.3		64.5	35.5	
Number of living children												
None	70.4	29.6	< 0.01	75.8	24.2	0.40	75.0	25.0	0.25	75.6	24.4	0.07
1–2	66.3	33.7		67.9	32.1		65.4	34.6		63.8	36.2	
3–4	62.3	37.7		67.5	32.5		66.3	33.7		62.4	37.6	
5 and above	59.8	40.2		67.9	32.1		66.9	33.1		64.5	35.5	
Ever terminated pregnancy												
Yes	–	–	–	69.8	30.2	0.08	70.1	29.9	< 0.01	64.3	35.7	0.42
No	–	–		67.3	32.7		64.2	35.8		63.3	36.7	
Visits for antenatal care												
Less than 4 visits	63.6	36.4	0.01	64.7	35.3	< 0.01	69.9	30.1	< 0.01	66.9	33.1	< 0.01
At least 4 visits or more	58.1	41.9		69.3	30.7		59.7	40.3		60.1	39.9	
Deliveries by skilled birth attendants												
Yes	54.7	45.3	< 0.01	64.2	35.8	< 0.01	63.5	36.5	< 0.01	61.9	38.1	< 0.01
No	64.8	35.2		70.7	29.3		69.7	30.3		68.1	31.9	
Ideal family size												
1–2	49.5	50.5	< 0.01	60.8	39.2	< 0.01	57.3	42.7	< 0.01	56.9	43.1	< 0.01
3–4	60.2	39.8		67.7	32.3		64.3	35.7		62.9	37.1	
5 and above	65.0	35.0		71.1	28.9		74.1	25.9		68.6	31.4	
Desire for more children / Fertility intention												
Wants more children	69.2	30.8	< 0.01	68.9	31.1	0.12	68.1	31.9	< 0.01	65.6	34.4	0.01
Wants no more	58.2	41.8		67.0	33.0		64.6	35.4		62.4	37.6	
Current use of contraception												
Yes	51.9	48.1	< 0.01	65.8	34.2	0.03	63.6	36.4	< 0.01	59.5	40.5	< 0.01
No	64.4	35.6		68.8	31.2		67.7	32.3		66.0	34.0	
* P-value is based on the Chi-square test.												

Table 4

Bivariable logistic regression of Consanguinity with sociodemographic characteristics, reproductive health and fertility behavior

Characteristics	PDHS (1990–91)			PDHS (2006–07)			PDHS (2012–13)			PDHS (2017–18)		
	n = 4,061			n = 5,677			n = 7,446			n = 6,711		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Sociodemographic characteristics and co-variables												
Regions/Provinces												
Khyber Pakhtunkhwa	1			1			1			1		
Punjab	1.76	1.47–2.12	< 0.01	1.70	1.45–1.99	< 0.01	1.25	1.09–1.43	< 0.01	0.93	0.81–1.07	0.30
Sindh	1.48	1.20–1.84	< 0.01	2.11	1.76–2.53	< 0.01	1.64	1.39–1.92	< 0.01	1.74	1.47–2.05	< 0.01
Baluchistan	2.19	1.50–3.19	< 0.01	2.05	1.51–2.78	< 0.01	1.51	1.17–1.95	< 0.01	1.13	0.89–1.45	0.31
Gilgit Baltistan	–	–	–	–	–	–	0.70	0.41–1.21	0.20	–	–	–
Islamabad	–	–	–	–	–	–	0.88	0.43–1.82	0.75	0.76	0.44–1.32	0.34
FATA	–	–	–	–	–	–				0.79	0.56–1.12	0.19
Geographical classification												
Rural	1			1			1			1		
Urban	0.55	0.48–0.64	< 0.01	0.60	0.53–0.68	< 0.01	0.49	0.45–0.55	< 0.01	0.72	0.65–0.80	< 0.01
Respondents' age												
15–24 years	1			1			1			1		
25–34 years	0.80	0.68–0.94	< 0.01	0.86	0.75–0.99	0.04	0.77	0.68–0.87	< 0.01	0.75	0.65–0.84	< 0.01
35 years and above	0.72	0.60–0.86	< 0.01	0.91	0.77–1.07	0.27	0.78	0.67–0.90	< 0.01	0.74	0.63–0.86	< 0.01
Respondents' education status												
Uneducated	1			1			1			1		
Primary	0.99	0.79–1.24	0.93	0.87	0.74–1.02	0.08	0.81	0.70–0.92	< 0.01	0.84	0.73–0.97	0.02
Secondary	0.50	0.41–0.61	< 0.01	0.69	0.59–0.81	< 0.01	0.55	0.49–0.63	< 0.01	0.66	0.58–0.75	< 0.01
Higher	0.37	0.20–0.67	< 0.01	0.51	0.41–0.64	< 0.01	0.38	0.33–0.45	< 0.01	0.43	0.37–0.50	< 0.01
Husbands' education status												
Uneducated	1			1			1			1		
Primary	1.41	1.17–1.69	< 0.01	1.02	0.86–1.21	0.79	1.11	0.95–1.28	0.17	1.13	0.96–1.33	0.12
Secondary	1.11	0.96–1.29	0.16	0.94	0.82–1.07	0.33	0.91	0.81–1.02	0.10	0.83	0.73–0.94	0.01
Higher	0.77	0.56–1.05	0.09	0.89	0.75–1.06	0.21	0.77	0.66–0.89	< 0.01	0.66	0.57–0.77	< 0.01
Respondents' employment status												
Unemployed	1			1			1			1		
Employed	1.22	1.02–1.45	0.02	1.33	1.17–1.51	< 0.01	1.67	1.49–1.87	< 0.01	1.09	0.95–1.24	0.19
Husbands' employment status												
Unemployed	1			1			1			1		
Employed	0.84	0.52–1.35	0.47	0.97	0.71–1.35	0.89	0.79	0.54–1.18	0.25	0.70	0.50–0.98	0.03
Mass media exposure												
No	1						1			1		
Yes	0.74	0.65–0.85	< 0.01	–	–	–	0.71	0.64–0.79	< 0.01	0.78	0.71–0.87	< 0.01
Respondents' healthcare decision-making autonomy												
No							1			1		

Characteristics	PDHS (1990–91)			PDHS (2006–07)			PDHS (2012–13)			PDHS (2017–18)		
	n = 4,061			n = 5,677			n = 7,446			n = 6,711		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Yes	–	–	–	–	–	–	0.76	0.69–0.84	< 0.01	0.89	0.83–0.96	< 0.01
Wealth quintile												
Poorest	1			1			1			1		
Poorer	1.13	0.89–1.43	0.31	0.68	0.57–0.81	< 0.01	0.69	0.59–0.82	< 0.01	0.63	0.54–0.74	< 0.01
Middle	0.77	0.61–0.96	0.02	0.57	0.48–0.69	< 0.01	0.54	0.46–0.63	< 0.01	0.65	0.55–0.76	< 0.01
Richer	0.74	0.60–0.92	< 0.01	0.49	0.41–0.59	< 0.01	0.36	0.31–0.42	< 0.01	0.47	0.41–0.56	< 0.01
Richest	0.73	0.59–0.90	< 0.01	0.46	0.39–0.56	< 0.01	0.33	0.28–0.39	< 0.01	0.35	0.30–0.41	< 0.01
Reproductive health and fertility behaviors												
Respondents' age at first birth												
< 20 years	1			1			1			1		
20–34 years	0.91	0.80–1.04	0.17	0.86	0.77–0.96	0.01	0.63	0.57–0.70	< 0.01	0.71	0.64–0.78	< 0.01
35–49 years	0.69	0.30–1.58	0.38	0.37	0.14–0.97	0.04	0.75	0.34–1.65	0.48	0.45	0.24–0.83	0.01
Gravidity												
6 and above	1			1			1			1		
3–5	1.10	0.94–1.29	0.23	0.98	0.85–1.14	0.86	0.94	0.81–1.07	0.37	0.96	0.82–1.12	0.61
1–2	1.35	1.13–1.60	< 0.01	1.05	0.90–1.23	0.51	0.94	0.82–1.08	0.41	0.99	0.84–1.16	0.91
Parity												
5 children and above	1			1			1			1		
3–4 children	0.98	0.84–1.15	0.88	0.87	0.76–1.00	0.05	0.95	0.84–1.07	0.38	0.93	0.81–1.06	0.26
1–2 children	1.15	0.98–1.34	0.07	0.92	0.81–1.05	0.23	0.88	0.78–0.98	0.02	0.97	0.86–1.10	0.65
Number of living children												
5 children and above	1			1			1			1		
3–4 children	1.11	0.94–1.29	0.19	0.98	0.85–1.13	0.79	0.97	0.85–1.11	0.69	0.91	0.79–1.05	0.20
1–2 children	1.32	1.13–1.54	< 0.01	1.00	0.87–1.14	0.98	0.93	0.83–1.05	0.28	0.97	0.85–1.11	0.68
None	1.61	0.95–2.71	0.07	1.45	0.91–2.32	0.12	1.44	0.86–2.41	0.16	1.70	1.02–2.84	0.04
Ever terminated pregnancy												
No				1			1			1		
Yes	–	–	–	2.31	2.06–2.59	< 0.01	1.31	1.18–1.45	< 0.01	1.10	1.02–1.19	0.01
Visits for antenatal care												
Less than 4 visits	1			1			1			1		
At least 4 visits or more	0.79	0.66–0.95	0.01	1.83	1.65–2.03	< 0.01	0.64	0.58–0.70	< 0.01	0.74	0.67–0.83	< 0.01
Deliveries by skilled birth attendants												
No	1			1			1			1		
Yes	0.66	0.56–0.77	< 0.01	1.79	1.64–1.95	< 0.01	0.75	0.68–0.83	< 0.01	0.76	0.68–0.85	< 0.01
Ideal family size												
5 children or above	1			1			1			1		
3–4 children	0.81	0.70–0.94	0.01	0.63	0.53–0.75	< 0.01	0.62	0.56–0.70	< 0.01	0.78	0.69–0.87	< 0.01
1–2 children	0.53	0.40–0.69	< 0.01	0.85	0.75–0.96	0.01	0.46	0.40–0.54	< 0.01	0.60	0.52–0.70	< 0.01
Desire for more children / Fertility intention												
Wants more children	1			1			1			1		

Characteristics	PDHS (1990–91)			PDHS (2006–07)			PDHS (2012–13)			PDHS (2017–18)		
	n = 4,061			n = 5,677			n = 7,446			n = 6,711		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Wants no more	0.62	0.54–0.71	< 0.01	0.92	0.82–1.02	0.12	0.86	0.78–0.94	< 0.01	0.87	0.78–0.96	0.01
Current use of contraception												
No	1			1			1			1		
Yes	0.59	0.49–0.72	< 0.01	0.87	0.77–0.98	0.02	0.84	0.76–0.92	< 0.01	0.76	0.68–0.84	< 0.01

Table 5

Bivariable logistic regression of Consanguinity with sociodemographic characteristics, reproductive health and fertility behavior

Characteristics	PDHS (1990-91)			PDHS (2006-07)			PDHS (2012-13)			PDHS (2017-18)		
	n = 4,061			n = 5,677			n = 7,446			n = 6,711		
	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value
Sociodemographic characteristics and co-variables												
Regions/Provinces												
Khyber Pakhtunkhwa	1			1			1			1		
Punjab	1.88	1.53–2.30	< 0.01	1.92	1.62–2.28	< 0.01	1.64	1.39–1.92	< 0.01	1.19	1.00–1.42	0.04
Sindh	1.81	1.42–2.31	< 0.01	2.36	1.93–2.88	< 0.01	1.91	1.58–2.29	< 0.01	1.96	1.59–2.41	< 0.01
Baluchistan	2.08	1.36–3.18	< 0.01	1.85	1.34–2.56	< 0.01	1.22	0.92–1.62	0.16	0.93	0.68–1.29	0.68
Gilgit Baltistan	–	–	–	–	–	–	0.57	0.32–1.01	0.05	–	–	–
Islamabad	–	–	–	–	–	–	1.63	0.76–3.46	0.21	1.32	0.72–2.39	0.36
FATA	–	–	–	–	–	–	–	–	–	0.56	0.37–0.85	< 0.01
Geographical classification												
Rural	1			1			1			1		
Urban	0.63	0.52–0.76	< 0.01	0.66	0.57–0.77	< 0.01	0.74	0.64–0.85	< 0.01	1.09	0.95–1.26	0.20
Respondents' age												
15–24 years	1			1			1			1		
25–34 years	0.89	0.72–1.24	0.35	0.95	0.79–1.14	0.58	0.92	0.79–1.08	0.34	0.86	0.73–1.02	0.09
35 years and above	0.83	0.60–1.14	0.25	1.01	0.78–1.29	0.94	0.93	0.74–1.17	0.54	0.84	0.66–1.06	0.16
Respondents' education status												
Uneducated	1			1			1			1		
Primary	0.97	0.74–1.25	0.79	0.92	0.77–1.09	0.34	1.01	0.86–1.19	0.86	0.89	0.76–1.07	0.23
Secondary	0.52	0.39–0.69	< 0.01	0.78	0.64–0.95	0.01	0.83	0.69–0.98	0.02	0.82	0.69–0.97	0.02
Higher	0.35	0.17–0.73	< 0.01	0.58	0.43–0.79	< 0.01	0.59	0.46–0.75	< 0.01	0.66	0.53–0.83	< 0.01
Husbands' education status												
Uneducated	1			1			1			1		
Primary	1.54	1.26–1.87	< 0.01	1.14	0.96–1.37	0.14	1.29	1.10–1.53	< 0.01	1.39	1.15–1.67	< 0.01
Secondary	1.64	1.36–1.97	< 0.01	1.30	1.12–1.52	< 0.01	1.46	1.27–1.68	< 0.01	1.35	1.14–1.59	0.01
Higher	2.12	1.42–3.17	< 0.01	1.52	1.22–1.90	< 0.01	1.77	1.46–2.13	< 0.01	1.27	1.04–1.55	0.02
Respondents' employment status												
Unemployed	1			1			1			1		
Employed	1.07	0.88–1.30	0.47	1.04	0.91–1.20	0.54	1.23	1.08–1.39	< 0.01	0.90	0.77–1.06	0.22
Husbands' employment status												
Unemployed	1			1			1			1		
Employed	0.76	0.46–1.27	0.29	0.92	0.65–1.29	0.62	0.72	0.47–1.09	0.12	0.69	0.46–1.02	0.06
Mass media exposure												
No	1			–	–	–	1			1		
Yes	0.91	0.77–1.08	0.28	–	–	–	1.01	0.88–1.16	0.85	1.04	0.90–1.20	0.58
Respondents' healthcare decision-making autonomy												
No	–	–	–	–	–	–	1			1		

Characteristics	PDHS (1990-91) n = 4,061			PDHS (2006-07) n = 5,677			PDHS (2012-13) n = 7,446			PDHS (2017-18) n = 6,711		
	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value
Yes	–	–	–	–	–	–	0.83	0.74–0.92	< 0.01	0.92	0.82–1.04	0.17
Wealth quintile												
Poorest	1			1			1			1		
Poorer	1.08	0.84–1.40	0.52	0.78	0.64–0.94	0.01	0.79	0.66–0.95	0.01	0.67	0.54–0.83	< 0.01
Middle	0.85	0.66–1.08	0.18	0.67	0.55–0.82	< 0.01	0.63	0.52–0.77	< 0.01	0.72	0.57–0.90	< 0.01
Richer	0.82	0.65–1.04	0.10	0.62	0.49–0.78	< 0.01	0.45	0.36–0.55	< 0.01	0.55	0.43–0.71	< 0.01
Richest	0.89	0.71–1.13	0.34	0.73	0.56–0.96	0.02	0.53	0.41–0.69	< 0.01	0.47	0.35–0.62	< 0.01
Reproductive health and fertility behaviors												
Respondents' age at first birth												
< 20 years	1			1			1			1		
20–34 years	0.98	0.83–1.16	0.87	0.94	0.82–1.08	0.39	0.73	0.65–0.83	< 0.01	0.82	0.72–0.95	< 0.01
35–49 years	0.99	0.38–2.60	0.98	0.30	0.11–0.83	0.02	0.86	0.37–1.99	0.72	0.83	0.39–1.76	0.62
Gravidity												
6 and above	1			1			1			1		
3–5	0.88	0.67–1.15	0.35	1.08	0.86–1.37	0.48	1.15	0.93–1.43	0.20	1.21	0.93–1.56	0.15
1–2	0.87	0.52–1.46	0.61	1.52	1.01–2.31	0.05	1.60	1.11–2.32	0.01	1.10	0.72–1.70	0.66
Parity												
5 children and above	1			1			1			1		
3–4 children	0.73	0.54–0.97	0.03	0.64	0.48–0.86	< 0.01	1.00	0.78–1.29	0.97	1.16	0.87–1.54	0.32
1–2 children	0.46	0.28–0.75	< 0.01	0.58	0.37–0.89	0.01	0.79	0.55–1.15	0.23	1.08	0.72–1.63	0.70
Number of living children												
5 children and above	1			1			1			1		
3–4 children	1.37	0.98–1.91	0.06	1.53	1.10–2.13	0.01	1.23	0.93–1.64	0.15	0.91	0.65–1.26	0.58
1–2 children	2.48	1.34–4.58	< 0.01	1.43	0.84–2.44	0.19	1.23	0.78–1.94	0.36	1.11	0.66–1.88	0.69
None	2.83	1.16–6.88	0.02	2.15	1.02–4.54	0.04	1.35	0.66–2.77	0.41	1.57	0.72–3.44	0.26
Ever terminated pregnancy												
No				1			1			1		
Yes	–	–	–	1.10	0.96–1.27	0.16	1.29	1.15–1.44	< 0.01	1.11	0.99–1.26	0.08
Visits for antenatal care												
Less than 4 visits	1			1			1			1		
At least 4 visits or more	1.45	1.13–1.86	< 0.01	1.00	0.86–1.16	0.97	0.85	0.75–0.97	0.02	0.99	0.87–1.13	0.94
Deliveries by skilled birth attendants												
No	1			1			1			1		
Yes	0.84	0.67–1.04	0.11	0.91	0.79–1.04	0.18	1.08	0.96–1.22	0.22	0.93	0.80–1.08	0.35
Ideal family size												
5 children and above	1			1			1			1		
3–4 children	1.52	1.10–2.09	0.01	0.98	0.84–1.13	0.74	0.69	0.61–0.80	< 0.01	0.87	0.59–0.87	0.06
1–2 children	1.55	1.13–2.14	0.01	0.74	0.60–0.92	< 0.01	0.64	0.53–0.78	< 0.01	0.72	0.74–1.01	< 0.01
Desire for more children /Fertility intention												
Wants more children	1			1			1			1		

Characteristics	PDHS (1990-91)			PDHS (2006-07)			PDHS (2012-13)			PDHS (2017-18)		
	n = 4,061			n = 5,677			n = 7,446			n = 6,711		
	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value
Wants no more	1.28	1.08–1.52	< 0.01	1.03	0.88–1.20	0.69	1.03	0.89–1.18	0.66	0.90	0.78–1.04	0.16
Current use of contraception												
No	1			1			1			1		
Yes	0.84	0.67–1.05	0.13	1.04	0.91–1.19	0.59	1.06	0.95–1.19	0.29	0.90	0.81–1.04	0.17