

**RESEARCH PAPER****Consanguine (Cross-Cousin) Marriages and Child Mortality in Pakistan: An Evolutionary Perspective****Suneel Kumar¹ and Asif Ali Sandeelo²**

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***Corresponding Author:** suneelkumr@usindh.edu.pk**ABSTRACT**

Consanguine marriages or cross-cousin marriages are one of the most practiced marriages type in South Asia and especially Pakistan. From biological point of view these marriages create high risk of genetically transferred disease among the children and can increase child mortality rates. This articles employes evolutionary theory, life history and demographics to understand the complexity of consanguine marriages and their relationship with the child mortality rates. Using systematic literature review approach this article conducted the systematic review of literature on the issues to understand it. It was found in the review that the relationship between consanguine marriages and child mortality rate is significant however, socio-economic and political factors motivate the close relatives to opt for consanguine marriages. This paper recommends that people should be educated about the risks of genetic diseases due to consanguine marriages, and more steps should be taken such as genetic testing before marriages to reduce the mortality rates.

KEYWORDS: Consanguine, Cross-Cousin Marriages, Child Mortality**Introduction**

Consanguine or cross-cousin marriages are one of the most common marriages throughout the world, especially in places like Africa, the Middle East, and South Asia. More than 10% of marriages are cross-cousin (Bittles and Black 2010). In Pakistan cross-cousin marriage practices has solid grounds and percentages are highest in the world. Pakistan demographic and health survey data suggests that almost 49.6% of women are related to their spouse as first-cousin and 8.3% as second cousin (NIPS and ICF 2019). Although, the tend is slightly decreasing in recent times, yet it is the most practice marriage system in Pakistan.

Literature shows several socio-economic benefits of cross-cousin marriages . These include but are not limited to sustaining the social capital, strengthening the family and tribal ties, maintaining the financial capital especially land holding and reducing the financial cost of marriages that also include reduced dowry and payments, greater compatibility of spouses that can also reduce the domestic violence, and in some cases access to opportunities to migration abroad (Agha 2016; Bittles 2012; Hussain and Bittles 1999; Joshi et al. 2014). Other studies, have shown economic and political development to higher prevalence of consanguinity arguing that cross-cousin marriages maintain the political structure of the family or group and holds the power within that group (Bildirici et al. 2010; Sailer 2003; Schulz 2022; Woodley and Bell 2013). These studies suggest that consanguine marriages are complex issues and require greater scholarly attention to understand the socio-economic and political reasons that encourage people to opt for cross-cousin marriages.

From socio-economic and political domains, other studies have focused on health issues related to cross-cousin marriages. One of the most important argument scholars suggest is that cross-cousin marriages increase the health risks, especially rare genetic diseases because of reduced gene pool, and can increase the neonatal and child mortality rate. Anzar Uallah et al. (2017) are of the view that consanguine marriages contribute to various genetic diseases such as congenital malformations, neonatal mortality, rare genetic disorders, and others. They call for genetic screening and counseling before cross-cousin marriages. Studies show the link between cross-cousin marriage and blood disorders, especially thalassemia. Analyzing the data from Pakistan Demographic and Health Survey from 1991 to argue that cross-cousin couples children may face child mortality. In this context, it is important to understand the child mortality due to cross-cousin marriages. Among various theories, the evolutionary theory and life history theory can enlighten us on the relation between consanguine marriages and child mortality in Pakistan and elsewhere.

Literature Review

Pakistan Demographic and Health Survey (PHDS) is part of Demography and Health Survey that is conducted globally in more than 90 countries. It is one of the most comprehensive surveys on relations between demography and health. Although, it reports numerous issues, challenges and solutions, but for this paper, we will focus on consanguine marriages and child mortality rates in Pakistan. The survey is conducted to inform evidence-based policies, tracking progress, changes, and challenges including findings gaps.

According to survey, almost 72.2% of all marriages in Pakistan were consanguine in 1990-91 which increased in 2017-18 survey to 63.4%, showing some kind of stability among the people to prefer the consanguine marriage. Similarly, the first cousin marriages between two surveys have remained almost same as in 1990-91 50.3% were first cousins to their spouse. In 2017-18 survey these figures were 49.6%. As discussed below in detail, there are numerous socio-economic and political reasons for such as high prevalence of consanguine marriages in Pakistan.

Moreover, the relationship between consanguine marriages and child mortality rate is very visible in the survey. The survey informs that in 1990-91, almost 91 infants died per 1000 births, which were significantly declined to 61 per 1000 births in 2017-18. Similarly, child under five years morality rate was 117 per 1000 births in 1990-91 survey and significantly declined to 74 per 1000 births. While the neonatal mortality rate was 51 per 1000 births in 1990-91, which also slightly decreased to 42 per 1000 births.

Table 01
Comparative analysis of PDHS 1990-91 and 2017-18

Description	1990-91 PHDS	2017-18 PHDS	Remarks
Total Consanguine marriages	62.7%	63.4%	Almost stable
First-Cousin marriages	50.3%	49.6%	Almost stable
Infant Mortality Rate	91 per 1000	62 per 1000	Decline
Under-5 years Mortality Rate	117 per 1000	74 per 1000	Decline
Neonatal Mortality Rate	51 per 1000	42 per 1000	Slow Decline

Source: PDHS – 1990-91 and 2017-18

Scholars who have explored these surveys and other literature strongly suggest a close relationship between consanguine marriages and children mortality rate. However, as we see below, the evolutionary and life history suggests some relationships between consanguine marriages and child mortality, but this is not a determinant factor. Bittles et al. (1993) studies the consanguine marriages in various cities of Punjab, Pakistan and found a relationship between child morality and cross-cousin marriages. However, according to them, the first-cousin marriages are said to have more child

mortality than other cross-cousin marriages. Similarly, Shami et al. (1989) found most deaths of neonatal and infants of parents who are first cousins. While Grant and Bittles (1997) found similar co-relation between cross cousin marriages and child mortality rates, however, they argue that adverse effect of survival is mostly until 4-5 years of age.

Outside Pakistan, studies in India also shows similar results. Banerjee and Roy (2002) studied parental consanguinity and offspring mortality. They argue, in India, parental consanguinity does not have significant relation to child mortality, disagreeing with earlier studies. However, Kuntla et al. (2013) found significant relation between parental consanguinity in India and stillbirths and miscarriages. Their results show that in cross-cousin marriages. These and many other studies suggest a adverse relationship between consanguine marriages and child mortality. However, let's explore these issues more using evolutionary and life history theories.

Evolutionary and Life History Theories of Consanguine Marriages

One of the important evolutionary successes is reproduction which requires a lot of energies and time in a life history of both male and female parents. The theory of parental investment measures the reproductive success of male and female tracing the investment of parents and impacts of biological (Trivers 1974; Trivers and Willard 1973) and socio-economic factors (Shenk 2004). If reproduction is evolutionary success, then are consanguine marriages, which are likely to increase the child mortality, especially in first-cousin marriage, as the above survey and studies show, anti-evolutionary? The main argument of the paper is, although consanguine marriages can increase child mortality, and other recessive gene disorders but the evolutionary and demographic indicators related to consanguinity show the work of selection in consanguinity resulting in prevalence of high reproductive span, and elevated live births increases the net optimization of reproduction (Hussain and Bittles 1999; Bittles and Black 2010).

In Pakistan consanguine marriage patterns are common, especially in Muslim population. People prefer first cousin marriage, followed by marriage within extended family, and in the *baradari* (lit. brotherhood, or same community) and then rarely outside community. Many studies suggest due to consanguine marriages, especially first-cousin marriage and inbreeding, the child mortality rate is high in Pakistan (Hussain et al. 2001; Hussain 2002). There are religious and economic reasons for consanguine marriages. Religiously, people believe that marrying within a community does not containment the "blood". While economically, as most of Pakistan is rural and engaged in agriculture, consanguineous marriages keeps the property within a family (Hussain 2002). Studies suggests, the consanguineous unions have risks of homozygosity, which leads to autosomal recessive disorders. According to online dictionary of medicine homozygosity is a "state of possessing two identical forms of a particular gene, one inherited from each parent. For example, a girl who is homozygous for cystic fibrosis (CF) received the cystic fibrosis gene from both of her parents and therefore she has cystic fibrosis". Due to homozygosity, the occurrences of death in the neonatal, post-neonatal, and during childhood especially in the first year of child are common (Hussain et al. 2001).

The study by Hussain et al. (2001) in the Muslim population of India and Pakistan suggest that the live births in Pakistan were 9.0% and 11.8% between infant and under-5 deaths, and a positive association between parental consanguinity and offspring-cousin unions were significantly more likely to die during the first year of life (Hussain et al. 2011, 780). Other than genetic (biological) issues, the demographic data show the inverse link between child morality and education. While paternal occupation observed was an excess risk of morality where the father was employed in the agricultural sector; most parents live in rural areas with poor health and sanitation facilities (781). The result shows the significant higher risk of neonatal morality in the first cousin marriage in India and Pakistan (781), due to gynecological immaturity of young mothers (782), and due to

combination of chromosomal anomalies and pregnancy complication associated with older maternal age (783). In post-neonatal mortality, the results show the elevated mortality for the progeny of women in first cousin unions (783). However, this study highlights the significance of demographic data concomitant by biological factors. For example, in aggregate, offspring mortality appeared to be primarily influenced by endogenous or biological factors during infancy, and exogenous or socio-demographic factors in the 1 to 4 years-age periods (785). Hence, the recurrent of sibling mortality involves both biological and socio-demographic factors (785).

The consanguinity has evolutionary history. Bittles and Black (2010) argues that during out-of-Africa migration around 60,000 to 70,000 years before present, and hunting and gathering existence of early groups, it would not be wrong to assume intragroup and intrafamilial marriages. Later, formation of tribes, and with sedentary lifestyle of agriculture consanguinity unions proliferated. The tribes of Israel provide robust example of clan/tribe endogamy resulted in genomic homozygosity (194). Bittles and Neel (1994) also explored first cousin marriages and child mortality rates in the context of inbreeding depression and lethal equivalents on a global scale. They synthesized global data and their results show a relationship between consanguinity and evolutionary genetic theory. Their results suggest relationship between, though not significant, survival depression and lethal equivalents.

Chisholm and Bittles (2015) use life history theory and development origine theory to find the answer to question: why consanguineous marriage persists and relates this to mortality and reproduction. By doing meta-analysis of 64 studies that found that 3.7% in all-cause mortality for the first cousin marriages. However, they argue that there is certain trade-off of this child mortality in the context of life history theory. This trade-off comes with high birth rates. In the past, Freire-Maia (1984) employed inbreeding theory to understand the risk of mortality by degree of kinship relations. She argues that the closer the relationship between the spouses, the higher the mortality rates. Thus, if spouses are first cousins, the mortality of their children will be higher. Among these biologically informed theories, there are other socio-economic and religious reasons that motivate cross-cousin marriage as argue above.

In Pakistan, the strong tribal and familial ties, as well as social factors like family prestige, property, and political affiliations enforces the endogamy leads to genomic homozygosity. The Muslim population in Pakistan lack the knowledge of adverse effects of consanguinity, or they believe in “evil eye” or “disease as the result of God’s wish not of individual mating choices” continues the practices of consanguinity among them. However, the same population acknowledges certain inherited diseases like diabetes, hypertension, and blood pressure with consanguinity which not necessarily is the case (Hussain 2002).

The question is consanguinity solely responsible for the elevated mortality? Bittles and Black (2010) believe that too much attention has been paid on the “effects of inbreeding on fertility and health” (197), while other factors like “social, economic, demographic, differential reproductive behavior, and early- and late-onset morbidity and mortality” (197) were given less importance. In this regard, there are two ways to approach the question raised in the beginning. Firstly, evolutionary using life history theory and parental investment, and second by considering the socio-demographic indicators.

Life history theory seeks to explain how natural selection and other evolutionary forces shape organisms to optimize their survival and reproduction in the face of ecological challenges posed by the environment (Stearns 2000; Roff 2000), Hence, life history theory informs of the various trade-offs that happen during the life history of an individual for survival. On the other hand, parental investment is a branch of life history

theory traces the investment of parents in reproduction both biological (Trivers 1972; Trivers 1974, Trivers & Willard 1973) and socio-economic investment (Shenk 2004). Biologically, female invest larger energies in pre-production, production and during postproduction care of offspring than male, and male usually compensate female's energies while providing food, security, and other conducive environment to both female and offspring for the reproductive survival. But still female life history investment is larger than male. The way natural selection works in this regard depends upon many factors, important is how female selects the mate (Trivers 1974).

The socio-demographic factors like marriage arrangements, female autonomy, marital violence, divorce rates, age of marriage, age of first birth, reproductive span and other factors influence the consanguinity along with morbidity and mortality (Bittile and Black 2010). Both factors (biological and social) inextricably interact with each other. Norms restrict the mate selection in consanguine marriages, resulting in the influence of social factor over biological. Bettile and Black (2010) highlighted the similar kind of results in many studies (199). On the other hand, consanguinity shows elevated reproductive behavior as due to early marriages (social factor) the reproductive span (biological factors) increases, and the higher live births compensate for parental investment in the case of the early child mortality (200).

These factors suggest that evolution favors consanguine marriages. As the homozygosity increased, and the "enhanced expression of rare recessive genes and thus increase in selection" (Bettile and Black 2010). The work of natural selection is also evident from the fact that although consanguine marriages occurred as early as 60,000 years before present, the small tribal groups and population have survived human genome. Without the selection this would have been impossible (Bettile and Black 2010). There is debate among scholars that although, consanguine marriages increase recessive gene diseases and natural selection would "purge the deleterious recessive genes from the gene pool" (Sanghvi 1966 cited in Bettile and Black 2010: 203), but no substantial evidence were found to support the claim in traditional societies practicing consanguine marriages.

Material and Methods

This study conducts a systematic literature review to synthesize findings on consanguineous marriages and child mortality. Systematic literature review is a powerful method to synthesis already established research on sensitive topics such as consanguine marriages and child mortality issues (Munn et al. 2018). In the context of Pakistan, Pakistan Demographic and Health Survey (PHDS) of 1990-91 and 2017-2018 was reviewed in detail to get comparative analysis of both surveys. The PHDS is one of the most comprehensive works on the relation between consanguineous marriage and child mortality rates informing what factors influence people to opt for consanguineous marriages despite growing awareness. Moreover, detailed analysis of report of the National Institute of Population Studies (NIPS) – 2000 was conducted. The NIPS report has analyzed the data published by PHDS. To further understand the topic, peer-reviewed articles were systematically identified through database searches including PubMed, Scopus, and Web of Science using combinations of key terms related to consanguinity, child mortality, evolutionary theory, and life history theory in South Asia and Pakistan. In the search results more than 120 papers appeared related to key words. The criteria of inclusion and exclusion were employed to discard papers which were not relevant to this topic. Based on the criteria, selected papers were systematically reviewed to extract conclusions, systematically evaluated for methodological quality, and organized into thematic categories reflecting evolutionary mechanisms and demographic patterns. Findings were synthesized to answer the question and to identify how evolutionary frameworks have been applied to understand the relationship between consanguinity and mortality outcomes to better understand the issues.

Results and Discussion

Consanguineous marriages were explored as a biomedical and public health problem, showing a significant correlation of adverse reproductive and child health outcomes. This literature repeatedly links consanguine marriages or close relative marriages to cause genetic diseases and a higher prevalence of certain genetic disorders than among non-consanguineous marriage couples. These genetic risks are also discussed alongside evidence of mortality, especially among neonatal, infant, and under-five-year-old children. However, the mortality is also influenced by various factors such as population dynamics and the quality of health systems. Thus, consanguine marriages inform the ways biological vulnerabilities and social conditions transverse in increasing the certain genetic disorders or child mortality. The biological or genetic model is more influential as it provides evolutionary relation between consanguinity and health risks. When marriage continuously happens within the same group over generations, the genetic study suggests, they tend to transfer the identical copies of genes to offspring. This is called inbreeding in which biological fitness of genes can decrease, and genes can express the deleterious recessive variants. Thus, population genetics inform that this will also enhance the cases of homozygosity. In other words, when close relatives marry, they are the carrier of a gene pool, and if both parents carry the harmful recessive gene, it is more likely to transfer in the offspring of that couple. Moreover, biology cannot alone determine mortality. Various cultural practices, social networking and support, the effectiveness of health systems, and other factors also influence child mortality. Thus, a deeper understanding of the issue requires taking into account the multiple social, cultural, economic, and political factors. These factors influence the children's mortality in multiple ways. Without due consideration of these factors, it would not be possible to fully understand the challenges of child mortality.

Yet the question is whether cross-cousin marriages are not beneficial to the community in evolutionary terms, then why are such marriages high in certain populations, and why is there no decline in such marriages? Although there can be no definite answer to this question, the expectation that genetic illness would be consistently visible among populations or even among all the children of couples is not true. One child can show the recessive gene disorder, and another cannot. This creates doubts among the population whether there are any biological phenomena at work or if it is the "will of God." Moreover, as argued above, the persistence of cousin marriages and child mortality is often shaped by the social and economic arrangements that make kin unions attractive in specific contexts.

The question of "benefit" from an evolutionary perspective is also complex. Arguing that consanguine marriages are not "beneficial" to a population biologically discards the social and kin network cooperation benefits. From a socio-bio evolutionary perspective, the social network and cooperations is as beneficial as biological fitness. Thus, a marriage occurs within a group; it strengthens the social alliances, protects resources, reduces marital conflict and divorce risk, protects women in patrilineal settings, and stabilizes intergenerational support networks. In the above context, the trade-off theory helps us to understand the motivation behind consanguine marriages. In an extended family network, families often prefer marriages within close groups. There are numerous reasons for this, such as keeping the family property within them, fear of inclusion of "outsiders" in the family network, social pressures, and, many times, creating and/or strengthening political affiliations between families are more important than biologically informed genetic diseases. In this context, it is important to explore these issues beyond biology. Thus, it is important to understand that social networking is also an "advantage" from evolutionary perspective for the child survival.

Moreover, it is also important to consider the population dynamics in terms of high and low fertility rates. For example, Pew Research Center's global demographic estimates report that Muslim women have higher total fertility than several other major groups—around 2.9 children per woman compared with 2.6 among Christians, with lower fertility among other groups. This may not be directly related to the explanation of consanguine marriages, but it helps us understand that certain groups can have high fertility rates and thus tend to have high mortality rates. This also helps us understand that in certain populations, social and kinship networking can be more important than biologically determined challenges.

Thus, the relationship between consanguineous marriage and child mortality is a complex issue and cannot be determined by a single factor only. The genetic risk framework can help us identify the evolutionary and historical reasons to understand the increased homozygosity and the enhanced genetic disorder, but it cannot explain why close relative marriages are preferred by communities, especially in Pakistan. Thus, a biological and evolutionary perspective can provide helpful logic on the risks of kin marriages and push us to understand that the occurrences of consanguine marriages are not about the failure of awareness only but are shaped by various socio-economic and political factors.

Conclusion and recommendations

To conclude, this paper does not undermine the biology and the genetic risk framework. However, the paper recommends following Anzar Uallah et al. (2017), who argue that genetic testing should be mandatory before consanguine marriages, which would allow us to reduce genetic diseases and reduce the child mortality rates. This perspective also calls for better governance from the government side. More affordable genetic testing can motivate people to do testing of their recessive genes that may cause genetic disorders in their children before marriage. Moreover, it also requires extensive and comprehensive programs from the government to educate people on the risks of genetic diseases due to consanguine marriages.

In the above context, saying that consanguine marriages should be discouraged is not the ultimate solution. From an evolutionary perspective, it is not clear if the genetic configuration that changes due to fewer and less consanguine marriages, whether "selected" new genetic make-up, would be beneficial to parents and their children. The natural selection process is not only complex but also unpredictable, and it does not work in a linear order of improvement. Moreover, it is also important to understand that, following trade-off theories, consanguine marriages do have socio-economic and political motivations.

The relationship between consanguineous marriage and child mortality should be understood within broader evolutionary and demographic situations. And none of these factors is more important than the others. They all carry equal significance. A more nuanced approach would be to consider a multifaceted understanding of the issues that include social, economic, political, kinship, as well as biological risks.

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