

Factors Contributing to at Risk Marriages among Individuals with Hemoglobinopathy Disorders Attending Premarital Screening Centers in Al-Ahsa Governorate, Saudi Arabia- 2021-2022

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ABSTRACT

Aim: Results from the Premarital Screening Program suggest that approximately 48% of couples with Hemoglobinopathy disorders decided to proceed with their marriage. This study determines the frequency of at-risk marriage among couples with Hemoglobinopathy disorders in Al Ahsa, Saudi Arabia and determines factors that influence their decision to proceed with at-risk marriage.

Materials and Methods: Of the 182 couples identified, 116 (63.7%) married and 66 (36.3%) did not marry. An unmatched case-control study was conducted on 81 subjects who married (cases) and 44 subjects who did not marry (controls) to assess the relationship between sociodemographic characteristics, knowledge, and cultural factors in regard to the decision to marry.

Results: In the case-control study, a low education level was associated with a decreased risk to proceed with at-risk marriage (OR=0.16, p-value=0.03). "It is my fate and I have to accept it" was among the most reported factors that influenced individuals to proceed with at-risk marriage (15%). Fifty percent of those who did not proceed with at-risk marriage were convinced by the importance of having healthy children. Roughly 75% of the married group and 61% of the unmarried group were not aware of the aim of the Premarital Screening Program.

Recommendations: raise the awareness of premarital screening program and to implement the screening at earlier stage. Counselor has to address different social, cultural and religious factors that may contribute to proceed with at-risk marriage.

Conclusion: The study's findings indicate that strong social, cultural, and religious factors lead to the reduced effectiveness of premarital counseling in the Al Ahsa region of the KSA.

Key words: Premarital, Screening, At-risk marriage, Marriage, Factors

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INTRODUCTION

Hemoglobinopathies (e.g., sickle cell disease [SCD] and thalassemia) are inherited blood disorders that are considered to be a significant public health problem [1].

Globally, approximately 5.2% of the world population is carriers of a hemoglobin gene variant of SCD or thalassemia, and 4.4% were of Eastern Mediterranean origin. Globally, the carriers of SCD are 40%, but due to its high carrier prevalence, it causes more than 80% of disorders [2]. The risk of couples having children with hemoglobinopathies was 1.1%, while 2.7 individuals per 1,000 conceptions are affected [3]. In the Kingdom of Saudi Arabia (KSA), hemoglobinopathies are especially important due to its high prevalence, primarily in the eastern provinces, as well as in the southwestern provinces. Roughly 4.2% of the Saudi population carries the trait of sickle cell and 0.26% has SCD [4]. In the eastern province, approximately 16.89% of population carries

the trait and 1.2% has SCD [5,6]. This high prevalence of inherited blood disorders is linked to consanguineous marriage, which constitutes approximately 60% of marriages in the KSA, as many families believe that this type of marriage will strengthen the families' attachment [7]. Additionally, large family size with an average of 6-7 children per family may increase the likelihood of passing the mutant gene to the next generation [8-11].

Inherited blood disorders directly and indirectly impact individuals and families [12]. Bone marrow transplantation is the only treatment available for both disorders [13]. The high cost of this treatment makes it restrictive for special cases. The burden of these disorders is effectively reduced by implementing prevention programs [14,15]. In the KSA, the Premarital Screening Program (PMS) was established by law in 2003 for the prevention of inherited hemoglobinopathies and certain infectious diseases [16]. The program targets 2 inherited hemoglobinopathies (i.e., SCD and thalassemia) and 3 infectious diseases (i.e., viral hepatitis B [HBV], viral hepatitis C [HCV], and human immunodeficiency virus [HIV]). It aims to identify the at-risk couples who were carriers of or afflicted with hemoglobinopathies. Moreover, it enables healthcare workers to intervene early based on the identified risk. Interventions include genetic and behavioral counseling sessions, vaccination, treatment of infection, and contraceptive advice [17,18].

Premarital screening is mandatory in the KSA for all individuals who intend to marry. After screening, couples are issued a certificate of premarital screening that enables them to proceed with marriage. Currently, at-risk couples (i.e., with incompatible results detected by screening) are not prevented from marrying. They are referred to counseling clinics to be educated about the health risks for their children and complications of disease if they proceed with an at-risk marriage. A qualified and well-trained counselor leads four counseling sessions, which couples and their parents should attend. At the end of the fourth session, the couple must decide whether or not to proceed with the at-risk marriage. If they insist upon proceeding with the at-risk marriage, then they will be issued an incompatibility

certificate [19].

The prevalence rate of SCD and thalassemia after program implementation was assessed in a large national study. The data was obtained from the Premarital Screening Program from the period between 2011-2015. This study found that the prevalence rate of beta-thalassemia has decreased to 12 in 2015 compared to 24.2 in 2011. Moreover, the prevalence rate of SCD was constant in these 2 years and ranged between 42.3 in 2011 and 49.8 and 2015. The highest prevalence rate for SCD and beta-thalassemia was observed in the eastern and southern regions. This result emphasizes the importance of improvement of the preventive measures and of raising awareness among populations in high-risk regions to reduce the rate of these disorders [6].

The prevalence of SCD and thalassemia remains high despite the implementation of the Premarital Screening Program [20]. This study aimed to measure the frequency of at-risk marriage among couples with Hemoglobinopathy disorders and to explore the factors that influence at-risk marriages for premarital screening centers attendees in the Al-Ahsa governorate, which has the highest rates of inherited hemoglobinopathies. This study also attempted to assess the knowledge among premarital screening center attendees. Assessing these aspects is important for policymakers in the public health field to improve the program services for a better outcome.

METHODS

Study design, setting, and participants

The current unmatched case-control study was conducted at the two premarital screening centers (i.e., Al Nuzha and Al Khaldyah) in Al Ahsa governorate, in the eastern region of the KSA from January 1, 2021 to May 31, 2022. During the study period, all subjects with incompatible screening results due to hemoglobinopathy were invited to participate (n=364), and subjects who gave consent were included in the study (Figure 1). The case group (232 subjects) was defined as participants with

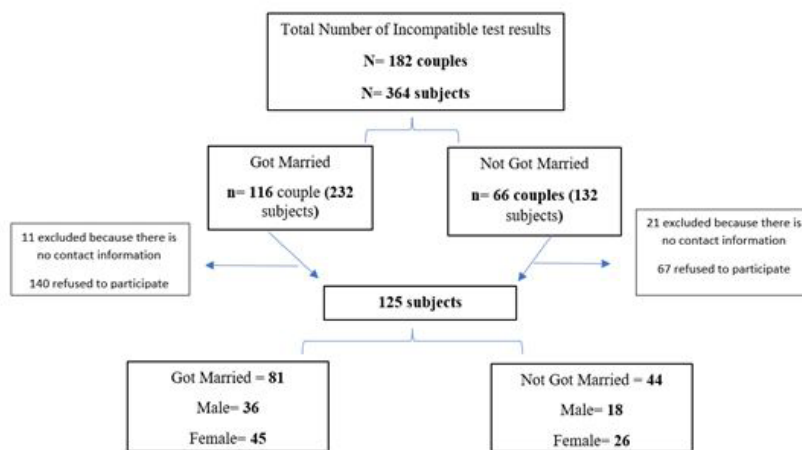


Figure 1: Flowchart of selection of cases and controls from premarital screening centers in Al Ahsa, 2021-2022.

incompatible screening results due to hemoglobinopathy disorders who got married and were thus subjected to at-risk marriage. The control group (132 subjects) was defined as participants with incompatible screening results due to hemoglobinopathy disorders who did not marry and were thus not subjected to at-risk marriage.

Data collection procedures and analysis

A self-administered questionnaire was developed in Arabic to collect the required data based on a literature review [21]. The research team and two experts reviewed the questionnaire for both face and content validity. The questionnaire was sent via Whatsapp to all subjects with incompatible screening test results, and it covered the following variables:

Socio-demographic and medical history data (i.e., age, gender, residency area, education level, monthly income, relationship to partner, marital status, and premarital screening test result).

Knowledge about the Premarital Screening Program and hemoglobinopathies (i.e., the aim of the program, how it affects children, available treatment for hemoglobinopathies, and whether they are curable diseases or not).

Cultural, familial, and religious factors that influence the

decision to proceed with at-risk marriage.

Chi-square analyses were done for qualitative data, and logistic regression was conducted for the adjustment of possible confounders.

Ethical considerations

Each participant gave written informed consent prior to completing the questionnaire. The aim of the study was clearly stated for participants, and they were reassured about the confidentiality of their information.

RESULTS

Of the 364 subjects identified from medical records as having incompatible test results, 32 subjects were excluded due to missing contact information. The questionnaire was sent to 332 subjects, of which 207 subjects refused to participate and 125 completed the questionnaire and were included in this study. Of the 125 individuals included in this study, 81 represented cases (i.e., who proceeded with at-risk marriage) and 44 represented controls (i.e., who did not proceed with at-risk marriage).

Demographic characteristics

Table 1 presents the demographic characteristics of

Table 1: Relationship of sociodemographic characteristics to marriage decision for at-risk individuals from premarital screening centers in Al Ahsa in 2021-2022.

	Case N=81	Control N=44	Odds Ratio (95%CI)		P- value
	n (%)	n (%)	Unadjusted	Adjusted*	
Gender					
Male	36 (44.4%)	18 (40.9%)	1.16 (0.55-2.43)		
Female	45 (55.6%)	26 (59.1%)			
Age (years)					
≤ 25	29(35.8%)	20(50%)	1.79(0.85-3.78)	1.2(0.51-2.79)	0.68
>25	52(64.2%)	22(50%)	Reference	Reference	
Residency					
City	55 (67.9%)	31 (70.5%)	Reference	Reference	0.62
Village	26 (32.1%)	13 (29.5%)	0.78 (0.4-1.97)	1.24(0.53-2.86)	
Education Level					
Less than secondary	13 (16%)	2 (4.5%)	0.19(0.04 – 0.95)	0.16(0.03-0.87)	0.03
Secondary	39 (48.1%)	19 (43.2%)	0.61(0.28 – 1.33)	0.49(0.21-1.16)	0.11
Higher Education	29 (35.8%)	23 (52.3%)	Reference	Reference	
Job					
Governmental Sector	11 (13.6%)	5 (11.4%)	Reference	Reference	
Private Sector	32 (39.5%)	15 (34.1%)	1.03 (0.30 – 3.50)	2.78(0.75-10.32)	0.13
Student	13 (16%)	15 (34.1%)	2.53(0.70-9.24)	1.11(0.32-3.82)	0.87
Not Working	25 (30.9%)	9 (20.5%)	0.79 (0.22 -2.91)	0.81(0.22-3.02)	0.76
Monthly Income (SR)					
< 5,000	47 (58%)	29 (65.9%)	2.53(0.70-9.24)	3.59(0.76-16.90)	0.11
5.000 – 10,000	24 (29.6%)	12 (27.3%)	1.7(0.39 – 7.21)	2.52(0.53-11.93)	0.24
> 10,000	10 (12.3%)	3 (6.8%)	Reference	Reference	
Marital Status at Screening					
Never Married	56 (69.1%)	37 (74.4%)	2.36 (0.93-6.01)	2.25(0.82-6.21)	0.12
Second or more	25 (30.9%)	7 (15.9%)	Reference	Reference	
Relation with Partner					
Consanguineous	34 (42%)	13 (29.5%)	0.58(0.27-1.27)	0.45(0.19-1.05)	0.07
None	47 (58%)	31 (70.5%)	Reference	Reference	

*Adjusted for age, residency area, monthly income, education level, relation to partner, degree of marriage.

the participants. The majority of the married group (64.2%) are over 25 years old and 35.8% are under 25. Fifty percent of the unmarried group are under 25 and 50% are over 25. The participants' age was statistically non-significant with the decision to proceed with at-risk marriage (OR=1.79). Females represent 55.6% of the married group and 59.1% of the unmarried group, while males represent 44.4% of the married group and 40.9% of the unmarried group. The majority of the married (67.9%) and unmarried groups (70.5%) live in the two cities of Al Ahsa, while 32.1% of the married group and 29.5% of the unmarried group live in Al Ahsa's villages. The participants who live in the two cities are less likely to proceed with at-risk marriage compared to participants living in the villages areas (OR=0.78).

Most of the married subjects (48.1%) had a secondary education, 35.8% had higher education, and 16% had less than secondary education. However, the majority (52.3%) of unmarried subjects had a higher education, 43.2% had secondary education, and 4.5% had less than secondary education. A statistically significant association exists between level of education and the decision to proceed with at-risk marriage. Those who had less than secondary education was less likely to proceed with at-risk marriage (OR=0.16, p-value=0.03).

Most married subjects (39.5%) were employed in the private sector, 30.9% were not employed, 16% were students, and 13.6% were employed in the governmental sector. By contrast, 34.1% of unmarried subjects were employed in the private sector, 34.1% were students, 20.5% were not employed, and 11.4% were employed in the governmental sector. Being employed in the private sector increased the risk of proceeding with at-risk marriage (OR=2.78) compared to governmental sector employees. Roughly 58% of married subjects and 65.9% of unmarried subjects are low income. Low-income participants were more likely to proceed with at-risk marriage than high-income participants (OR=3.59). It was the first marriage for 69% of married subjects and

74.4% of unmarried subjects, which tends to increase the likelihood of proceeding with at-risk marriage compared to participants who have been married before. The majority of the participants were not related to each other; in 58% of married subjects and 70.5% of unmarried subjects, consanguinity tended to decrease (OR=0.45, p-value=0.07) the risk of proceeding with at-risk marriage compared to participants who are not related to each other.

Disease status among participants

The majority of participants were SCD carriers: 87.7% and 86.4% in the married and the unmarried groups, respectively (Figure 2). Sickle cell disease was seen in 4.9% of married subjects and 4.5% of unmarried subjects, while 1.2% of married subjects and 2.3% of unmarried subjects were diagnosed with thalassemia. Thalassemia traits were evident in 6.2% of married subjects and 6.8% of unmarried subjects.

Knowledge of premarital screening program

Participants were asked about the aim of the Premarital Screening Program, and 24.7% of the married group and 38.6% of the unmarried group knew the aim (Table 2). The majority of participants in the married group (89%) and in the unmarried group (95.5%) are aware that SCD and thalassemia are inherited blood disorders. Moreover, 91.4% of the married group and 88.6% of the unmarried group believed that SCD and thalassemia may affect their children's health. The majority of participants in both the married (84%) and unmarried groups (86.4%) believe that SCD and thalassemia are curable diseases.

Reasons for proceeding with at-risk marriage

The 81 participants who decided to proceed with at-risk marriage were asked about the factors that affected their decision (Figure 3). They listed 12 reasons; in descending order of prevalence, they are as follows: (1) "it is my fate and I have to accept it" (n=29, 15%); (2) "I know couples with inherited blood diseases who

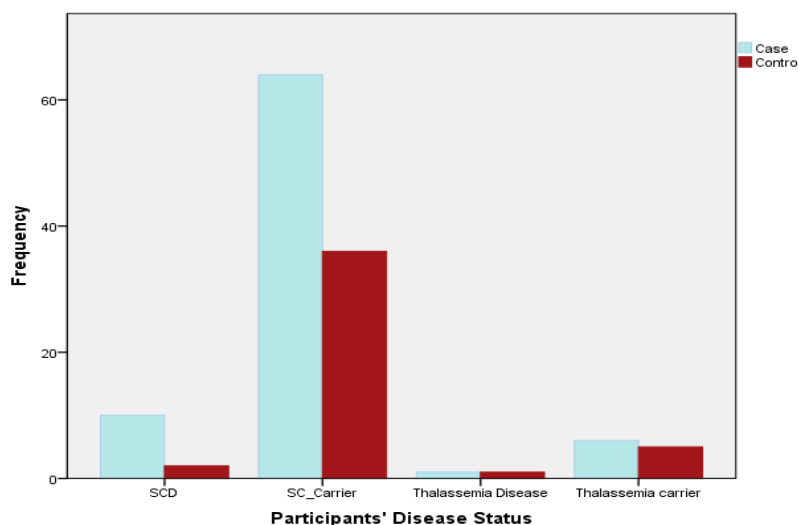


Figure 2: Participants' disease status.

Table 2: Relationship of participants' knowledge and the decision of marriage for at-risk individuals from premarital screening centers in Al Ahsa in 2021-2022.

	Case N=81 n (%)	Control N=44 n (%)	Odds ratio (95% CI)	P- value
The Aim of Premarital Screening				
Correct answer	20(24.7%)	17(38.6%)	1.92 (0.87 -4.22)	0.1
Incorrect answer	61(75.3%)	27(61.4%)		
Sickle Cell Disease and Thalassemia are Inherited Diseases				
Correct answer	72(88.9%)	42 (95.5%)	2.63 (0.54-12.73)	0.22
Incorrect answer	9 (11.1%)	2 (4.5%)		
Sickle Cell Disease and Thalassemia Can Affect Children's Health				
Correct answer	74 (91.4)	39 (88.6%)	0.74 (0.22-2.48)	0.62
Incorrect answer	7 (8.6%)	5 (11.4%)		
People Can Be Cured from Sickle Cell Disease and Thalassemia				
Correct answer	13 (16%)	6 (13.6%)	0.83 (0.29-2.35)	0.72
Incorrect answer	68 (84%)	38 (86.4%)		

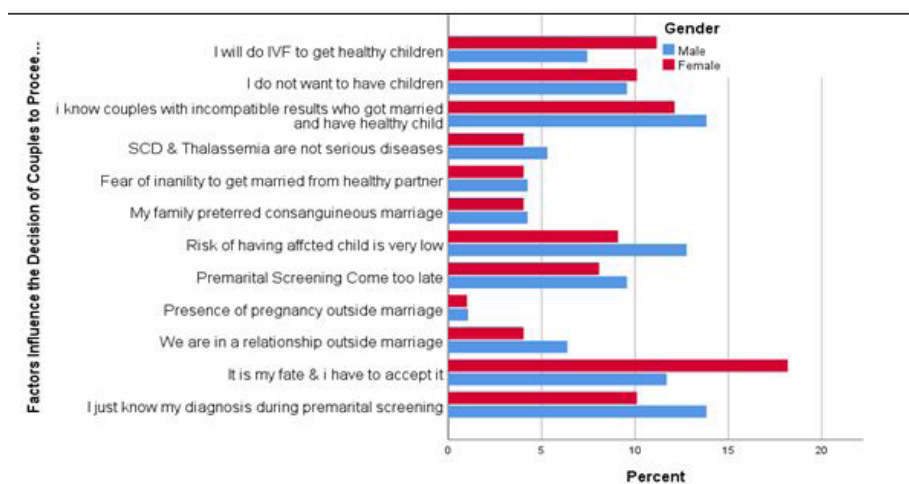


Figure 3: Factors influencing the decision to proceed with at-risk marriage among participants from premarital screening centers in Al Ahsa in 2021-2022.

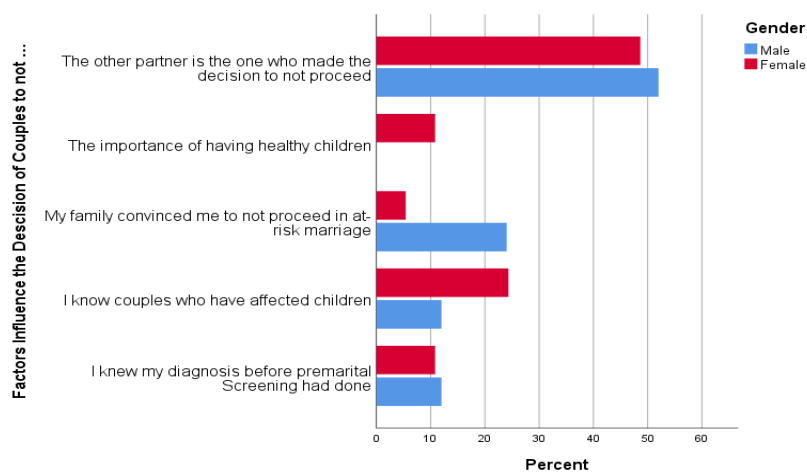


Figure 4: Factors influencing the decision to not proceed with at-risk marriage among participants from premarital screening centers in Al Ahsa in 2021-2022.

have healthy children” (n=25, 13%); (3) “I just found out about my diagnosis when I took the premarital screening test” (n=23, 11.9%); (4) “I will have in-vitro fertilization” (n=22, 11.4%); (5) “the risk of having affected children is low” (n=21, 10.9%); (6) “I do not want to have children”

(n=19, 9.8%); (7) “premarital screening occurred too late after the marriage decision had been made” (n=17, 8.8%); (8) “presence of relationship outside marriage” (n=10, 5.2%); (9) “SCD and thalassemia are not serious diseases” (n=9, 4.7%); (10) “my family preferred

consanguineous marriage" (n=8, 4.1%); (11) "fear of inability to marry a healthy partner" (n=8, 4.1%); and (12) "presence of pregnancy outside marriage" (n=2, 1%).

Reasons for not proceeding with at-risk marriage

The 44 participants who decided not to proceed in at-risk marriage were asked about the factors that influenced their decision (Figure 4). They listed five reasons; in descending order of prevalence, they are as follows: (1) "the importance of having healthy children" (n=31, 50%); (2) "I know couples who have children with SCD and thalassemia" (n=12, 19.4%); (3) "my family convinced me to not proceed with an at-risk marriage" (n=8, 12.9%); (4) "I knew my diagnosis before taking the premarital screening test" (n=7, 11.3%); and (5) "the other partner is the one who decided to not proceed" (n=4, 6.5%).

Logistic regression analysis

After adjustment for the confounders (i.e., age, residency area, income, education level, relation to partner, and degree of marriage), participants with less than secondary education are more likely not to proceed with at-risk marriage (OR=0.16, 95% CI=0.03-0.87, p-value=0.03).

DISCUSSION

The KSA implemented the Premarital Screening Program in 2004. It is a mandatory test for all couples who intend to marry. Since couples with incompatible test results are not prohibited from proceeding with at-risk marriage, the efficacy of the program depends on the percentage of at-risk marriages averted [21]. The findings of this study convey that program success was not achieved, as approximately 63.7% of couples with incompatible test results due to hemoglobinopathies chose to proceed with at-risk marriage [22]. Alswaidi et al. reported that roughly 88% of at-risk couples proceeded with at-risk marriages in 2005-2006, and this figure decreased to 48% in 2009 [8,23,24].

Nationally, there has been a decrease in the prevalence rate of B-thalassemia, while the prevalence rate of SCD remains high [20]. The high prevalence of SCD is expected since couples often proceed with at-risk marriage. This finding emphasizes the presence of a knowledge gap in regard to the factors that influence a couple's decision to proceed with at-risk marriage and how to improve counseling sessions to modify individuals' behavior. This study discussed the possible factors that influence a couple's decision.

Sociodemographic Factors influencing a couple's decision

The Al Ahsa governorate is the largest part of the eastern region of the KSA. Hofuf et al. are its two main cities where the two premarital screening centers are located. There is wide variety of cultures and social composition across Al Ahsa [25]. This study showed that the majority of incompatible test results are due to the sickle cell trait,

which is consistent with the prevalence pattern in the country [26].

There has been an increase in the average age of marriage in the KSA in recent years. Most marriages occur at age 26 [27]. In this study, the average age of marriage was 30 years, and it was the first marriage for the majority of participants. The high prevalence of hemoglobinopathies were linked to consanguineous marriage, which constitute 60% of marriages in the KSA, as the families believe that this type of marriage will strengthen their attachment [28]. In this study, consanguinity decreased the risk of proceeding with at-risk marriage. This finding is indirectly related to the influencing factors listed in this study.

In this study, no difference existed in the demographic characteristics between those who married and those who did not and thus no statistically significant association with proceeding with at-risk marriage, except for education level. Participants with lower than secondary education level were less likely to proceed with at-risk marriage than those with a higher education (OR=0.16, p-value=0.03).

Knowledge

The majority of participants were not aware of the aim of premarital screening, and most of participants believed that inherited hemoglobinopathies are curable diseases. Moreover, approximately 11% of participants who proceeded with at-risk marriage believed that the risk of having affected children is low, while others believed that SCD and thalassemia are not serious diseases [29,30]. While knowledge is an important factor, it is not sufficient to prevent at-risk marriage since many social, cultural, and religious factors influence the decision [14,24].

Factors influencing the decision

Participants who did not know their disease or carrier state prior to the premarital screening and participants did the screening after they had decided to marry are more likely to proceed with at-risk marriage. Because they are committed to their decision and had initiated wedding arrangements, cancellation of the wedding was not considered to be an option. Screening at an earlier stage and before marriage proposals may help to prevent at-risk marriage. This finding is consistent with Al Khalifah et al., in which 68% of participants supported early testing of hemoglobinopathies in high school and university students and before engagement [14].

In this study, participants who were married divorced, or had children at the time of screening were less likely to proceed with at-risk marriage. These are unexpected results, according to Alswaidi et al. [22]. Additionally, the Islamic culture in the KSA influenced the decision, as 15% of participants believed that this is their fate which they must accept. This emphasizes the importance of involving religious leaders in communities to participate in health education. The presence of new technologies such as *in-vitro* fertilization influenced some participants

to proceed with at-risk marriage. These types of procedures are done for free in the KSA for special cases; otherwise, couples have to pay for them. In the study by Al Khalifah et al. approximately 34.5% preferred this alternative to ensure that their at-risk marriage would result in healthy children [14]. The findings of this study suggest that cultural and social factors may have a strong influence on the decision to proceed with at-risk marriage. This is consistent with Alswaidi et al. findings, in which fear of social stigma, inability to cancel a planned wedding, and familial pressure were among the most reported factors. This finding emphasizes the importance of considering cultural, social, and religious factors when counseling couples who have incompatible screening results.

LIMITATIONS

One limitation is the limited number of participants included in this study which affect the power.

CONCLUSION

The study's findings indicate that strong social, cultural, and religious factors lead to the reduced effectiveness of premarital counseling in the Al Ahsa region of the KSA. The religious factor relates to the belief that at-risk marriage is one's fate that they must accept. Another cultural factor is related to knowing couples who proceeded with at-risk marriage and yet had healthy children. Another factor is that the screening occurs late (i.e., individuals learn their disease status after taking the premarital screening test. This prevents the cancellation of a pre-planned wedding due to social commitments. These findings suggest a need to improve premarital counseling by considering cultural and religious factors. Furthermore, screening must occur at an earlier stage and before a marriage proposal to help prevent at-risk marriage.

RECOMMENDATIONS

Based on the study results, it is essential to raise awareness of inherited hemoglobinopathies as well as the Premarital Screening Program among individuals in the community. This will be achieved by including the students in the education programs and encouraging the religious leaders in each community to participate in increasing awareness among individuals. Moreover, offering premarital screening services at an earlier stage prior to a marriage proposal would help each partner to be aware of their diagnosis earlier and to make an informed decision. Considering the social and cultural factors in each counseling session is key to preventing at-risk marriage.

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