



Pandemic effects on rates of marriages, a cross-sectional COVID-19 study in Adham, Saudi Arabia.

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Abstract: Premarital screenings are such an important public health measure for couples planning to get married, which helps them lead healthy lives and give birth to healthy children. During this process couples are medically tested before their wedding to check out their health condition. If one of the spouses is infected or carries a disease, it can be transmitted to the other partner or inherited to the offspring. In this regard, screening is essential before getting married and recently in 2004, due to the detrimental effects on the health of the public, the quality of life of Saudis, and the unfavorable and negative impact on the Saudi economy, the Saudi government passed the law and premarital screening became a requirement for marriage approvals in the Kingdom. The Saudi Ministry of health (MOH) provides free access to these screening clinics, laboratories, and medical counseling. In this study, a community-based access cross sectional study was conducted to study premarital examinations in Adham Governorate, in western Saudi Arabia. There were 1,888 of couples that underwent screening tests in 2019 and 2020 out of which 98.35% were showing compatibility while the remaining 1.65% showed incompatibility. Furthermore, the screening tests were made for the specific three diseases hepatitis B, thalassemia, and sickle cell anemia. During the study, it was concluded after conducting interviews by public health interns alongside with primary source data collected and statistically analyzed that the number of screenings drastically dropped in the year 2020, due to COVID-19 pandemic and lockdown conditions, and recommended that MOH should introduce psychiatric consulting, drug and alcohol screening to the premarital screening protocol.

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1. Introduction

According to the United Nations Population Division, Saudi Arabia has a total population of over 22 million, of which 27.1% are non-Saudi expatriates. Approximately 250,000 couples marry in Saudi Arabia each year, according to the Ministry of Justice. A total of thirteen administrative regions separate the entire country. Although some areas have been divided into smaller districts, the Ministry of Health has created 20 health districts. Figure 1 shows the Ministry's network of 1,824 primary healthcare facilities and 200 hospitals, which it uses to provide free healthcare to all Saudi citizens. There are 123 medical facilities in Saudi Arabia with 70 laboratories and 20 clinics for genetic counseling due to the efforts of the Saudi government and the healthcare industry. The government of Saudi Arabia enacted a law starting on the 21st of February 2004 requiring premarital screening on planning couples' marriage licenses.



Figure 1 Administrative and Health Regions of Saudi Arabia (Al Hamdan et al., 2007)

AIDS, Hepatitis B, Hepatitis C, and other public health and infectious diseases are among the common "Genetic Blood Disorders" that prospective spouses are tested for before marriage. Premarital Screening (PMS) is the name given to this medical fitness test for couples (Alhosain, 2018). This approach makes preventing genetic disorders, congenital abnormalities, and various medical and psychosocial marital problems easier (N. K. R. Ibrahim et al., 2011). Because it is useful for identifying and preventing high-risk marriages (Ahmad, 2006). Most of the so called "Arab Muslim" countries utilized the premarital disease screening programs and declared this mandatory for every couple to get married to uphold the health of the society and avert the promulgation of contagious diseases among the people of the state. It was a real challenge to implement these regulations on the people without violating the human rights of the

public and abiding the rules of the Islamic religion. This program is not only for the utilization of premarital screening, but also is considered a method of public health counseling for both couple members alongside for their healthy life and healthy offspring. (Kooli & Abadli, 2018).

In addition to reducing the spread of disease, premarital screening also reduces the financial burden of treating it. This examination will prevent future social and psychological problems for families by reducing the burden on public health facilities and blood banks (Alsharit, 2015). It's difficult to pinpoint why some genetic diseases are more common in developing countries than others. Natural selection, kinship, and parents' advancing age are considered public health demographics that play a role and genetically affect the offspring. Hemoglobinopathies, such as sickle cell disease and sickle cell anemia, became a world-wide public health issue that is more common (Weatherall, 2010). Premarital counseling (PMC) is generally acceptable from a religious and ethical standpoint, as the prophet of Islam Mohammed peace be upon him has requested and advised his followers over fourteen centuries ago to; "choose for their kind" advising couples to be aware of the health of their offspring by properly choosing and planning, in addition it is also a health economic cost-effective measurement, positive cost benefit, and an encouraging return on investment to the community, due to its minimal governmental burden and financial requirements (El-Hazmi, 2006).

In this study, the premarital Screening tests have been made on couples that were going to be married during the years 2019 and 2020. For this particular study, screening were made for Hepatitis B, Sickle Cell Disease, and Thalassemia. Data was collected after signing confidential identities agreements with participants as results will be reported as group findings, ethical committee, institute review board's proposal approval, and by interviewing couples by Umm Al Qura college of Health sciences and public health department trainees and interns at MOH hospitals, followed by a IBM SPSS 24 statistical analysis of the data collected.

Literature Review

It is a global practice known as "premarital care" (PMC) that tries to identify and cure undiagnosed illnesses in spouses and children (N. K. Ibrahim et al., 2013). When it comes to identifying hemoglobinopathies in couples, premarital screening (PMS) may be a valuable technique (Balci et al., 2014). Middle Eastern nations have a high prevalence of genetic blood diseases, which may cause physical, mental, and economic disabilities. To limit the rising

number of these illnesses, premarital screening (PMS) is aggressively applied (Natarajan & Joseph, 2021). Religious and cultural views and illiteracy may also hinder premarital screening programs (Rahman et al., 2014).

Depending on the detected danger, it may present a chance to act, such as advice on HIV and other infections (as well as vaccinations), advice about contraception and treatment of a chronic illness are all part of this intervention (Moos et al., 2008). Medications to reduce teratogenic risk are also included. Newborn screening for sickle cell illness and premarital screening for sickle cell and thalassemia carriers are public health measures in Arab nations to avoid hemoglobin disorders (Hamamy & Al-Allawi, 2013). You must get premarital medical checkups to ensure a healthy and happy marriage. To limit the number of infants with genetic illnesses, premarital screening is a primary goal of this practice. Couples with a family history of a significant genetic disorder are carriers of the same faulty gene, have been exposed to specific chemicals or other environmental factors, or have any chromosomal abnormalities (Azeem et al., 2011). may benefit from this complete test suite. Premarital screening is essential since it is the main method of preventing pregnancy complications for couples. Before marriage, premarital counseling is offered to young couples to help guide, educate and prepare them for a healthy family structure (Mohamed et al., 2015).

Several premarital diseases can be controlled by screening, the topmost diseases are related to the liver abnormality, Hepatitis B and C are the most common premarital infections that may be prevented with routine screening. Hepatitis may be caused by viruses, bacteria, medication, and more. The severity of their symptoms distinguishes acute and chronic forms of the illness. Acute hepatitis is characterized by a sudden onset, extreme severity, and excruciating pain. Symptoms of acute disease are more distressing for patients, although they typically endure just a few weeks or months. Typical outcomes are only a small amount of liver cell damage and a lack of immune system activation. Hepatitis that lasts more than six months is known as chronic hepatitis. Cells that include hepatocellular cells are often seen in lymphocytes and plasma cells (Davidson et al., 2006). Chronic hepatitis B and C are the most common forms. Cirrhosis results from chronic hepatitis, which damages liver parenchymal cells (Jilani et al., 2011). Hepatitis B or Hepatitis C virus (HBV/HCV) infection is a leading cause of chronic liver disease, cirrhosis, and hepatocellular cancer in more than 500 million individuals globally (Rehermann & Nascimbeni, 2005). Hepatitis C virus (HCV) has been well recognized as a leading cause of chronic liver disease

since its identification in 1989. The World Health Organization's most recent estimate of the prevalence of HCV infection is 2%, or 123 million persons (Pert et al., 2014, p. 357).

When the hepatitis B virus (HBV) infects a person's bodily fluids, it may cause acute and chronic infections. The only natural host for HBV is humans. However, other bodily fluids, like semen and saliva, have also been linked to transmission (Nassal & Schaller, 1993). When the hepatitis B virus (HBV - Hepatitis B virus) incubates for a long period of time, it may produce acute and serious liver disease (Anzola, 2004). Hepatitis C, on the other hand, is a bacterial infection of the liver that produces inflammation. In certain cases, this might cause severe liver damage. Infected blood may transfer the hepatitis C virus to other people (Raja & Janjua, 2008; Shimotohno, 1995). According to Choo et al., this liver illness may be spread by direct contact with contaminated bodily fluids, such as by injectable drug usage or sexual interaction (Choo et al., 1990).

The severity of the signs and symptoms of hepatitis B varies widely. However, they may show up as soon as the second week after infection, even four months later. There are no symptoms in certain cases, such as in young toddlers (Welch et al., 1989). Tummy discomfort, dark urine, fever, joint pain, anorexia, nausea, vomiting, weakness, and jaundice may be present (Shaw et al., 1986). There is a 7-week incubation period for Hepatitis C virus (HCV) acute infection, although only one-third of individuals are icteric and have symptoms (4-20 weeks). Serum aminotransferase levels often rise more than 10-fold and fall to normal levels when symptoms and indications subside. At the time of commencement of symptoms, antibodies to HCV are generally, but not always, present (Lang et al., 2006).

Acute hepatitis B infection cannot be treated with any particular medication. A patient's comfort and nutritional balance are the primary therapy goals, including replenishing fluids lost via vomiting or diarrhea. An essential thing to remember is not to overuse medication. Taking acetaminophen/paracetamol and anti-emetic medications together is not recommended for patients (Marcellin et al., 2003). Before the advent of newer therapies for hepatitis C, many patients with the infection could not utilize them because of other health issues and intolerable side effects. However, all that has changed. Hepatitis C may now be cured by taking medicine every day for two to six months (Ghany et al., 2009).

Thalassemia, a genetic blood ailment that causes the body to have a lower-than-normal amount of hemoglobin, is the second main premarital disease. Oxygen-carrying red blood cells are made possible by

hemoglobin. Anemia may result from thalassemia. You'll feel exhausted as a result of this (Borgna-Pignatti et al., 2004; Cohen et al., 2004; Herbert L. Muncie & Campbell, 2009; Olivieri & Brittenham, 1997). People who suffer from thalassemia can marry naturally, and they can have children. A Thalassemia patient can enjoy good reproductive health if he adheres to the appropriate treatments for his condition from the beginning of his discovery of the disease (Barthel & Vignal, 2014). According to a study by Valentine et al., when a thalassemia carrier marries, it is not necessary to transmit this disease to all of his children. Marrying a person who is not a carrier of the disease, in each pregnancy, there will be a 50% chance that the child will have thalassemia mild, compared to a 50% that he will be healthy (Valentine & Neel, 1944).

Thalassemia is believed by Can et al. to be caused by a mutation in the hemoglobin-forming cells' DNA. Parent-to-child transmission of this mutation is possible. Hemoglobin levels fall, and red blood cell damage rises when genetic changes occur, resulting in lower quantities of hemoglobin (Herbert L. Muncie & Campbell, 2009). Mednick et al. found that red blood cells carry oxygen throughout the body. Hence, damage to these cells results in exhaustion, weakness, and shortness of breath, all indications of anemia, according to their findings. Because of this, anemia may occur in patients with thalassemia but to variable degrees (Mednick et al., 2010). These patients may need blood transfusions on a weekly or biweekly basis. Iron accumulates in the blood over time after a blood transfusion. This may harm the heart, liver, and other vital organs. Stem cell transplantation (bone marrow transplant) is recommended to treat iron overload caused by blood transfusions. Symptoms of thalassemia may be seen in newborns. During the first two years of life, it occurs in other youngsters. In certain cases, persons with just one defective hemoglobin gene do not show signs of thalassemia (Rachmilewitz & Giardina, 2011). Some babies show signs and symptoms of thalassemia at birth. It arises in other children during the first two years of life. Some people who have only one affected hemoglobin gene do not experience symptoms of thalassemia (Rund & Rachmilewitz, 2000).

SCA is the second premarital condition we are going to investigate, a disease produced by the creation of aberrant hemoglobin, which combines with other defective hemoglobin molecules inside the red blood cell to create hard deformation of the cell. If this distortion is present, the cell's capacity to flow through tiny vessels is hindered; this results in congested vessels and tissue ischemia (Loneragan et al., 2001; Mauling et al., 1949). This genetic disease is passed from parents to children through genes, The fetus gets

one gene from the father and the other from the mother. The fetus has sickle cell anemia, From the mother or a gene ("S") from the father and a gene ("S") must receive a gene ("13 THAL") (Thomas et al., 1982). Iron deficiency in the body is responsible for the production of hemoglobin in the blood (Serjeant, 1997). Deficiency in vitamin B12 and folic acid leads to impairment in the production or formation of red blood cells (Mohanty & Mukherjee, 2002). Sickle cell disease is one of the most common single-gene disorders in the world. The polymerization of hemoglobin leads to the hardening of red blood cells and blockage of blood vessels (Rees et al., 2010). There is no definitive cure; But there are medications that help prevent problems associated with this disease, such as Medicines to relieve pain. Folic acid supplement, Vaccination, and antibiotics (Hanna et al., 2007).

The premarital screening was also done previously in Saudi Arabia, Memish and Saeedi conducted research and discussed the screening in regards to thalassemia and sickle cell anemia from 2004 to 2009, as shown in table 1. In those six years, there were 1,572,140 tests conducted which is 10.9% of the Saudi population. The ratio of test positivity was 6.35% which leads to the number of 99,968 tests with positive results. While the remaining screening tests have shown negative results (Memish & Saeedi, 2011).

Table 1 Premarital Genetic Screening Program between 2004 and 2009 by year in Saudi Arabia

	2004	2005	2006	2007	2008	2009	Total
Saudi population	22673537	23128229	23678849	24242578	24807273	25373512	143903978
Marriage proposals	241825	246490	236629	255894	295018	296284	1572140
Positive results	18736	19133	16111	14455	15788	15745	99968
Negative results	223089	227357	220518	241439	279230	280539	1472172
Sickle cell disease							
Carriers	10141	10389	10094	11231	12432	12362	66649
Cases	645	606	706	812	823	721	4313
Total	10786	10995	10800	12043	13255	13083	70962
β-thalassemia							
Carriers	7746	7994	5223	2317	2400	2555	28235
Cases	204	144	88	95	133	107	771
Total	7950	8138	5311	2412	2533	2662	29006
Incompatible certificates	2441	2003	1281	1029	1000	1171	8925
Follow up of at-risk couples	1213	1162	481	622	721	1171	5370
Marriage cancellation among at-risk couples	112	135	89	194	287	608	1425

There were about 71% (70,962 tests) of the positive results led to the Sickle Cell Diseases while the remaining 29% (29,006) tests were showing the p-thalassemia. With the Sickle Cell Disease there were 66,649 patients were carriers and 4,313 were Cases.

Similarly, in the p-thalassemia-positive patients, 28,235 were carriers and the remaining 771 were cases. However, during the time span of 6 years, there were 8,925 incompatible certifications allotted to the couples, and 5,370 couples were taken on follow-up while the 1,425 certifications were canceled for the couples at risk (Memish & Saeedi, 2011).

Materials and Methods

Adham Governorate is situated in the southwest region of Makkah province. Adham region's borders are with the Emirate or province of Al-Baha, situated in the south-east, Maysan Governorate to the east, and Al-hajra, and Al-Laith Governorates to the south, west, and north. It allocates a small division of its southern borders with the "Al-Hajra Governorate" in the "Emirate of the Al-Baha region."

The area of the governorate is estimated to be at 1.45 thousand km², which occupies a little bit over 1.02% of the area, as it is the smallest city in the region in terms of area. The population of the province, according to the advisor's estimates for the year 2013 the population was approximately 53000 people, which is equivalent to 0.67% of the region's population, and it is the smallest rural town in the governorate of Makkah region in terms of area. Population sizes. In the last population count Adham and its affiliated villages during the year 2020 was about 55000 inhabitants.

There were 1888 participants selected based for this research study. The relevant data was collected using a questionnaire that included questions on basic information and types of common diseases in the premarital examination. The collected data was analyzed by the Statistical Package of Social Science (SPSS) software package version 24.0, and the results are shown in visual charts and tables.

Results

The collected data from the participants via questionnaire has been analyzed and the results are shown & discussed in this section. Table 2 is showing the number of premarital screening tests taking place in Adham Governorate, Saudi Arabi during the years 2019-2020. It is shown that in the year 2019, there were 1072 premarital screening tests taken place on the couples, and in the year 2020, these numbers dropped by 76%, and 816 tests took place, due to the COVID-19 pandemic and lockdown conditions. The total premarital screening tests that take place between these two years is 1888 in numbers out of which 1857 screening tests were compatible and the couples are qualified to be married while the 33 tests gone incompatible, the rate of cumulative incompatibility is 1.65%.

As we take a deep look into the data analysis, we found that in 2019 the compatible tests were 1053 while the incompatible tests were 19, showing an incompatibility ratio of 1.8%. As we move forward to 2020, we found there were 804 tests showing compatibility for the couples to get married while 12 premarital screening tests showed incompatibility tests. The incompatibility ratio dropped to 1.5% in 2020. This analysis is also shown graphically in figure 2.

Table 2 Premarital Screening Tests in Adham, Saudi Arabia 2019 - 2020

Year	2019	2020	Total
Number of tests	1072	816	1888
Compatible test	1053 (98.3%)	804 (98.5%)	1857 (98.35%)
Incompatible test	19 (1.8%)	12 (1.5%)	33(1.65%)

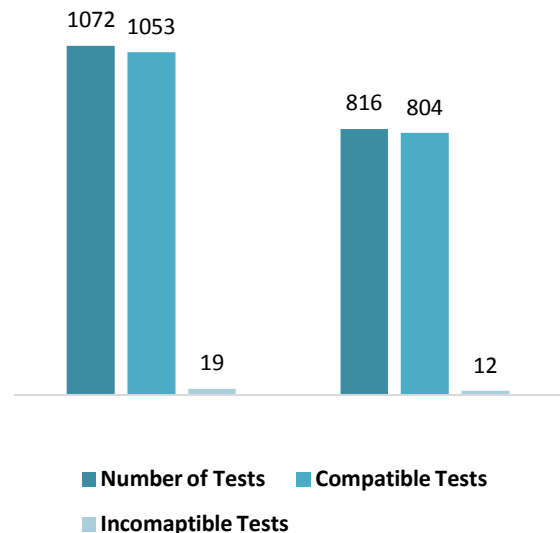
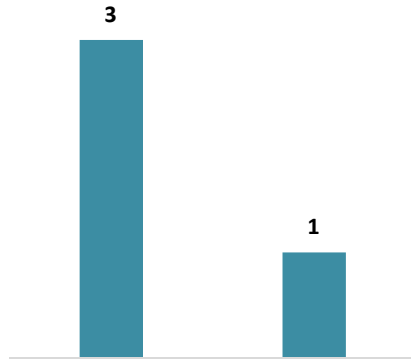


Figure 2 Premarital Screening Tests in Adham, Saudi Arabia 2019 – 2020

During these premarital screenings, specific tests for Hepatitis B have been made; in 2019 there were three tests for Hepatitis B but in the year 2020 the test numbers dropped by 67% and only one test had been made. Thus, in this couple of years, a total of four tests for Hepatitis took place. table 3 is showing the analysis in tabular form while figure 3 is showing this via graphical representation.

Table 3 Premarital Screening Tests for Hepatitis B in Adham, Saudi Arabia 2019 - 2020

Year	2019	2020
Hepatitis B	3	1



Similarly, the Thalassemia tests were also included during this premarital screening test in 2019 and 2020. There was a total of 12 tests made, out of which only five took place in 2020 and the remaining were made in 2019. There is also a reduction in test frequency noticed, in 2020 the premarital screening test for Thalassemia was reduced by 28.57%, as shown in Table 4 as well as figure 4.

Table 4 Premarital Screening Tests for Thalassemia in Adham, Saudi Arabia 2019 - 2020

Year	2019	2020
Thalassemia	7	5

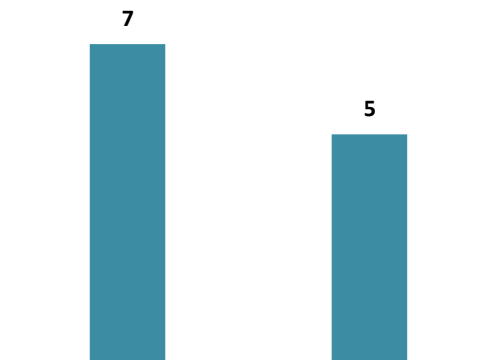


Figure 4 Premarital Screening Tests for Thalassemia in Adham, Saudi Arabia 2019 – 2020

Sickle Cell Anemia is also part of this screening test, a total of 15 tests were done and most of them were made in 2019. As far as concerned numbers, the year 2019 had nine screening tests for Sickle Cell Anemia while there were only 6 screenings in 2020, there is also a reduction of 33.3% noticed in the screening test frequency, as shown in figure 5 and table 5.

Table 5 Sickle cell anemia cases in premarital screening tests in Adham, Saudi Arabia 2019- 2020

Year	2019	2020
Sickle Cell Anemia	9	6

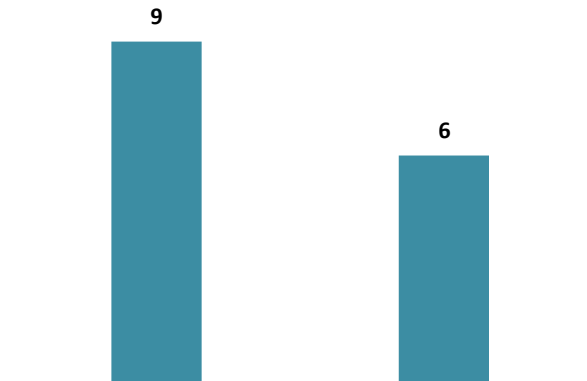


Figure 5 Sickle cell anemia cases in premarital screening tests in Adham, Saudi Arabia 2019- 2020

The holy Quran says that “We created you man and woman, and from separate and different families and tribes to know each other”. Also, It was reported that Prophet Mohammad (PBUH) over 14 centuries ago advised avoiding marriage with relatives by explaining that marriage between relatives results in genetic weaknesses in the offspring.

In addition, modern science helped in understanding many of God’s rulings, because “every reproduction in plants and animals, and by extrapolating that into man, the farther the two species move, the stronger the offspring in traits, because the closer the pair is to the connection of the blood structure and sexuality, the weaker offspring arises. crossbreeding process.”

Conducting pre-marital examinations is extremely important, to ensure the general and public health of spouses, their ability to marry, and to ensure

that both are freed from infectious diseases. As a preventative measurement, early detection of some diseases helps in rapid treatment, thus preventing their transmission to the other party. Researchers in this study found that most of the pre-marital examinations are not of any hindrance to marriage because the percentage of compatibility between couples were higher than the percentage of incompatibility. In addition, it was concluded in this study that hepatitis C testing and screening in the Adham governorate was rarely done, which required the public health interns to conduct more promotional health awareness and education to the public regarding this pathology and to encourage couples to start taking this screening test in particular.

The researchers in this study found out that the rate of Thalassemia examinations in Adham governorate became higher than before, and the percentage of sickle cell anemia tests were among the highest in Adham Governorate, due to the awareness of the community about sickle cell.

There are several recommendations made on the basis of the findings of this research:

1. Raising awareness about premarital screening and counseling to the youth of the nation by the association of non-governmental organizations (NGO) and community leaders, helping them understand the disadvantages of marriage between genetically incompatible couples.
2. In an Islamic society, people are always connected to religious leaders and worship places, it can be the best way to utilize the religious organizations such as mosques and sermons to pass health information to the public.
3. Confidentiality, autonomy, dignity, respect, and all other ethical principles of justice should be demonstrated and assured for those who go for premarital screening.
4. It is also recommended to add psychological health checks and screening and ensure both parties can take responsibility for the family without going through crises or psychological breakdowns and disorders that could have been avoided and dealt in advance and prior to marriage.
5. The researchers recommended to add drug testing as part of the MOH pre-marital examinations.
6. As a public health measure, the researchers recommend maternal testing during pregnancy, especially for those incompatible couples that were advised to not get married by the MOH counseling teams.

7. Mobile clinics should be used to collect specimens to increase rates of screening tests.

Conclusion and Limitations

A premarital screening study has been required for couples planning to get married in the governorate of Adham, Saudi Arabia. There were 188 couples that went through the screening tests in 2019 and 2020 out of which 98.35% were showing compatibility while the remaining 1.65% showed incompatibility. Furthermore, the screening tests were made for three diseases Hepatitis B, Thalassemia, and Sickle Cell Disease. During the study, it was noted that the number of screenings reduced categorically in the year 2020 and the reason for this reduction was the lockdown and curfew measurements imposed by the Saudi government at the time and to stop the spread of novel COVID-19 pandemic. Premarital screenings are such an important step regarding the health of the spouse, this will help the couple to lead a healthy life and give birth to healthy children.

There are also some limitations to the study where the research team had no access to more than one governorate, and due to limited numbers of MOH premarital clinics in rural western Saudi Arabia, hence the demand for conducting marriage screening dropped compared to 2018 and 2019 prior to the rise of the COVID-19 pandemic.

As public health professionals especially in rural areas and communities in Saudi Arabia, promotional health work must be done to raise awareness for improvement of the health of all.

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