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**A Comprehensive Evaluation of Premarital Screening Program in
Basrah (2020-2025): Statistical Trends, Genetic Counseling Impact, and
Infrastructure Readiness**

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Abstract:

Premarital screening (PMS) is a vital preventive strategy for managing hereditary blood disorders and infectious diseases. In Basrah, despite the program's long-standing implementation, the gap between clinical diagnosis and behavioral change remains a significant challenge. This study evaluates the effectiveness of the PMS program in Basrah (2020–2025), focusing on statistical trends, infrastructure readiness, and the impact of genetic counseling on the decision-making of high-risk couples. A multi-dimensional approach was employed, including a longitudinal analysis of 252,361 individuals (2020–2024) and a detailed cohort study of 58,034 participants in 2025. Data collection involved automated extraction from electronically linked centers and manual verification from peripheral outlets, supplemented by telephone interviews with high-risk couples. The findings revealed a 33% increase in screening volume over five years. In 2025, the prevalence of Thalassemia and Sickle Cell traits was 2.2% and 3.4%, respectively. Infrastructure assessment identified a technological divide, with 40% of centers still relying



on manual entry systems. In 2025, follow-up with high-risk couples revealed that 76.9% (176 couples) proceeded with marriage despite intensive counseling, while 23.1% (53 couples) chose to cancel their marriage plans. This reflects a growing but still limited impact of genetic counseling on behavioral change due to the late timing of the screening. While the program demonstrates high diagnostic efficiency, its preventive impact is severely hindered by socio-cultural pressures and late-stage testing. The study advocates a strategic shift toward routine school-based screening for adolescents to ensure early genetic awareness. Additionally, it recommends full digital integration of all centers and the establishment of a judicial requirement for intensive counseling for high-risk cases.

Keywords: Premarital Screening, Thalassemia, Genetic Counseling, Infrastructure Readiness, Marriage Cancellation, Basrah, Iraq, Public Health

Introduction:

Marriage is one of the most significant milestones in an individual's life, representing a social contract and a blessed union that serves as the cornerstone of a stable family⁽¹⁾. While built on compatibility and shared dreams, a successful marriage also demands mutual responsibility regarding the genetic and physical health of the future family unit^(2,3). To safeguard this institution, premarital screening (PMS) has emerged as a crucial preventive measure, ensuring that couples enter their lifelong commitment with a clear understanding of their health status^(4,5).

Premarital screening is defined as a panel of tests designed to identify genetic, infectious, and blood-borne disorders in couples planning to marry⁽⁶⁾. Its primary goal is to prevent the transmission of diseases to offspring⁽⁷⁾. Beyond individual benefits, these examinations reduce maternal and infant mortality, minimize birth defects^(8,9), and curb the spread of infectious diseases. Consequently, this lessens the financial and logistical burden on both the family and the national healthcare system⁽¹⁰⁾.

Globally, premarital screening programs have been implemented since the 1970s to improve reproductive health outcomes. In Iraq, this commitment was formalized under Public Health Law No. 89 of 1981, which mandated medical examinations for prospective spouses to ensure their health eligibility^(11,12). Following this, the program was launched in the Kurdistan region in 2008 and subsequently expanded to all Iraqi governorates by





2013⁽¹³⁾, comprehensive guidelines for clinical testing and counseling were established, requiring couples to obtain a premarital health certificate from designated primary healthcare centers⁽¹⁴⁾.

The current Iraqi screening protocol focuses on detecting viral infections and hemoglobinopathies, such as thalassemia and sickle cell anemia aligning with global trends and successful regional models in Oman, Saudi Arabia, and Egypt^(15,16,17,18). These services include detailed medical history, clinical examinations, and laboratory tests (including Blood Group & Rhesus factor (Rh) , Complete Blood Count (CBC), High-Performance Liquid Chromatography(HPLC) , Venereal Disease Research Laboratory (VDRL), Human Immunodeficiency Virus (HIV), Hepatitis B Surface Antigen (HBsAg), Hepatitis C Virus Antibody (HCV Ab), and Sputum examination for Tuberculosis (TB)), followed by professional counseling. Counseling serves as a vital educational tool, assisting couples in navigating complex decision-making processes regarding their reproductive future⁽¹⁹⁾.

Ultimately, premarital screening is an act of responsibility. By providing essential health knowledge, it empowers couples to build a secure foundation for their families, ensuring that their journey together is backed by medical foresight and peace of mind⁽²⁰⁾.

Problem Statement

Despite the institutionalization of the Premarital Screening (PMS) program in Basrah, hereditary blood disorders—specifically Thalassemia and Sickle Cell anemia—continue to pose a significant public health burden on the governorate's healthcare system. The core problem lies in a profound preventive-behavioral gap; while the program demonstrates high diagnostic efficiency in identifying carriers, it fails to achieve its primary objective of reducing the incidence of affected births. This failure is primarily attributed to the late timing of screening, which often occurs just days before the wedding ceremony when social and emotional commitments have become irreversible.

Furthermore, the program faces a critical technological disparity across Basrah's health outlets. Approximately 40% of the peripheral centers still operate on manual, paper-based systems, leading to data fragmentation and hindering the real-time tracking of high-





risk cases. Consequently, the lack of a unified digital infrastructure, combined with socio-cultural pressures that override medical counseling, creates a system that functions more as a legal formality than a medical preventive tool. Without addressing these infrastructural gaps and shifting toward earlier screening initiatives, the long-term clinical and economic burden of genetic disorders in Basrah will remain unabated.

Significance of Study

The significance of this study stems from the urgent clinical and administrative need to evaluate the Premarital Screening (PMS) program as a primary preventive strategy in Basrah. Its importance is underscored by the following contributions:

- **Epidemiological Mapping:** This research provides an updated and comprehensive epidemiological profile of Thalassemia and Sickle Cell traits in Basrah, based on a massive dataset of over 250,000 individuals. This data is crucial for precise health planning and resource allocation within the governorate.
- **Systemic Quality Improvement:** By identifying the technological divide where 40% of centers still rely on manual entry, this study offers a scientific basis for the Basrah Health Directorate to prioritize digital integration and laboratory upgrades.
- **Behavioral Insight and Preventive Impact:** Unlike routine reports, this study measures the actual success of the program by tracking the marriage cancellation rate among high-risk couples. It reveals the critical gap between clinical diagnosis and final marital decisions.
- **Policy and Legislative Support:** The findings provide a robust evidence base for policymakers to advocate for a strategic shift toward pre-engagement or school-based screening. This aim is to bypass socio-cultural pressures that currently hinder the program's preventive goals.
- **Economic Sustainability:** By identifying ways to improve the prevention of new genetic cases, the study contributes to reducing the long-term financial and logistical burden on the national healthcare system and the families in Basrah.



The Research Gap:

Despite the long-standing implementation of the Premarital Screening (PMS) program in Iraq, a significant knowledge gap persists regarding its operational effectiveness in the southern region, particularly in Basrah. Previous studies have largely focused on the clinical prevalence of hemoglobinopathies or general knowledge and attitudes among participants. However, there is a profound lack of evidence-based research addressing the technological divide and infrastructure readiness of screening outlets, where 40% of peripheral centers in Basrah still rely on manual data entry systems.

Furthermore, while global and regional literature emphasizes the importance of genetic counseling, there is limited local data evaluating the actual behavioral outcomes (marriage cancellation rates) among high-risk couples in the Basrah community. Most existing reports provide static statistical figures without exploring the critical impact of screening timing as a barrier to prevention. This study addresses these gaps by providing a multi-dimensional evaluation of the 2020–2025 period, integrating longitudinal epidemiological trends with an assessment of digital infrastructure and a direct follow-up on the decision-making process of high-risk couples. By doing so, it offers a contemporary scientific framework to transition the program from a mere diagnostic formality to a robust preventive strategy.

Objective of the study

1. General Objective: To evaluate the effectiveness and impact of the Pre-marital Screening (PMS) program in Basrah regarding Thalassemia prevention and infrastructure readiness.
2. Specific Objectives:
 - To analyze the epidemiological profile of individuals attending PMS centers in Basrah during the study period.
 - To assess the infrastructure and operational capacity of PMS centers using standardized performance indicators.
 - To measure the prevalence of Thalassemia carriers among couples visiting these centers.
 - To evaluate the outcome of genetic counseling by determining the marriage cancellation rate among high-risk couples (where both are carriers).





-To identify the factors influencing the final decision of high-risk couples regarding proceeding with or terminating the marriage.

MATERIALS AND METHODS

2.1 Study Area and Population

The study was conducted in the Basrah Governorate, Southern Iraq, which serves as a vital demographic and economic hub. The governorate's estimated population reached approximately 3,664,168 inhabitants according to the latest official statistical projections during the study period. To ensure a representative geographical coverage of both urban and rural districts, data were collected from ten major premarital screening (PMS) outlets. These facilities include the primary teaching hospitals in the city center: Al-Sadr Teaching Hospital, Al-Basrah Teaching Hospital, Al-Fayhaa Teaching Hospital, and Al-Mawani Teaching Hospital. Additionally, the study included peripheral general hospitals to capture data from outlying districts: Al-Zubair General Hospital, Al-Qurna General Hospital, Abi Al-Khasib General Hospital, Al-Fao General Hospital, Al-Medainah General Hospital, and Umm Qasr General Hospital. The study population for the primary analysis in 2025 consisted of a substantial cohort of 58,034 individuals (29,017 couples), providing a high degree of statistical power to evaluate the epidemiological trends and the impact of genetic counseling within the Basrah community.

2.2 Study Design

A Multi-Dimensional Approach

The research employs a multi-methodological design divided into three integrated parts to provide a holistic evaluation of the premarital screening program in Basrah:

Part I: Statistical Evaluation: A longitudinal analysis of laboratory test results and the volume of counseling recipients.

Part II: Impact Assessment: A cohort-based evaluation of the impact of genetic counseling on high-risk couples (both carriers of Thalassemia or Sickle Cell) regarding their final marital decisions





Part III: Infrastructure Readiness: An assessment of the technical and logistical capacity of the screening outlets.

2.3 Methodological Justification for 2025 Data Segmentation

A distinct methodological focus was placed on the year 2025, separating it from the 2020–2024 longitudinal series. This isolation is justified by several qualitative and technical upgrades introduced in 2025:

Advanced Diagnostic Indicators: The introduction of HbA1c (Glycated Hemoglobin) for diabetes screening and detailed Hemoglobin Typing.

Granular Classification: The ability to differentiate between Beta, Delta, and suspected Alpha Thalassemia, alongside other variants like Hb E and Hb D, which was made possible by upgraded laboratory infrastructure.

Enhanced Counseling Metrics: The systematic recording of Family Planning Counseling beneficiaries (11,646 individuals) and 100% coverage of health education for all applicants.

2.4 Infrastructure and Technical Assessment

The study evaluates the Infrastructure Readiness by documenting the deployment of advanced HPLC (High-Performance Liquid Chromatography) systems, specifically the Bio-Rad D10, across Basrah's hospitals. This part also analyzes the role of Electronic Linkage between laboratories and clinics in ensuring data integrity and streamlining the screening process for the large volume of applicants^(19,20). The study meticulously evaluated the infrastructure readiness across the ten screening outlets in Basrah. A key technical distinction was identified regarding data management systems:

Digital Integration: Six major outlets, primarily located in the city center (including Al-Sadr Teaching Hospital, Al-Basrah Teaching Hospital, Al-Fayhaa teaching hospital, Al-Mawani teaching hospital), and two outlets locating in the periphery (Al-Qurna general hospital, and Al-Zubair general hospital), have achieved full Electronic Linkage. This system allows for automated, real-time data synchronization between laboratories and medical clinics, ensuring high data integrity.





Manual Entry Systems: In contrast, four peripheral hospitals—Abi Al-Khasib, Al-Fao, Al-Medainah, and Umm Qasr General Hospitals—continue to utilize a manual, paper-based entry system.

2.5 Data Collection and Telephone Interviews:

Due to the hybrid nature of the data management systems in Basrah, a two-tiered data collection strategy was employed:

1-Automated Extraction: For the electronically linked hospitals, data were extracted directly from the digital health records, minimizing human error^(21,22,23).

2-Manual Verification: For the four outlets relying on paper records, the researchers performed manual data entry and verification to integrate their results into the central database.

This comprehensive approach ensured 100% geographical coverage of the governorate, accounting for both urban and rural screening outcomes. The inclusion of the entry method as a variable in the analysis allowed for a more nuanced understanding of the program's operational efficiency across different districts. For the impact assessment (Part II), a retrospective cohort approach was used. High-risk couples identified during the 2025 screening were contacted via telephone interviews. The follow-up phase and data collection for high-risk couples were conducted through a collaborative professional effort. The telephone interviews were carried out by the researcher, in her capacity as the Manager of the Premarital Screening Program at the Public Health Department in Basrah, alongside the physicians in charge of the respective screening outlets.

This multi-level communication approach was designed to ensure professional clinical guidance while maintaining administrative oversight. Each telephone session lasted approximately ten minutes, during which the team confirmed the couples' understanding of the genetic risks previously explained during their in-person counseling and documented their final marital decision. This collaborative methodology ensured a high response rate and provided a nuanced understanding of the behavioral outcomes within the local context.





2.6 Statistical Analysis

The data were analyzed using Descriptive Statistical Methods. The research focused on frequency distributions and percentage calculations to illustrate epidemiological trends from 2020 to 2025. Marital decisions of high-risk couples were evaluated based on percentage frequencies derived from telephone follow-ups to assess the program's practical impact.

2.7 Inclusion and Exclusion Criteria

To ensure the accuracy and representativeness of the study population, specific criteria were established for the participants involved in the multi-dimensional evaluation.

Inclusion Criteria:

-General Screening Population: All individuals (males and females) who visited the ten designated premarital screening outlets in the Basrah Governorate between 2020 and 2025.

-High-Risk Cohort: Couples identified in 2025 where both partners were confirmed carriers of Thalassemia or Sickle Cell Trait.

-Geographical Scope: Residents within the Basrah Governorate covering both urban and rural districts.

Exclusion Criteria:

-Incomplete Records: Individuals with missing laboratory results or those who did not complete the full mandatory screening panel.

-Non-Consenting Participants: For Part II (Impact Assessment), high-risk couples who could not be reached or declined to participate in the telephone interview.

2.8 Study Limitations

-Infrastructure Disparity: A significant technological divide exists between urban and peripheral centers. Four hospitals (Abi Al-Khasib, Al-Fao, Al-Medainah, and Umm Qasr) still utilize manual, paper-based entry systems, which poses a risk for human error and data fragmentation compared to electronically linked outlets.

-Follow-up Attrition and Randomness: In the assessment of high-risk couples, 53 cases (18.8%) were lost to follow-up due to unanswered calls or switched-off phones. This attrition is attributed to external technical factors rather than participant-specific





characteristics or clinical outcomes. Therefore, these missing cases are considered to be randomly distributed, ensuring that no systematic bias was introduced into the final analysis of the marriage completion or cancellation rates.

-Late-Stage Screening: The primary limitation of the program's preventive goal is the timing of the tests. Since most couples undergo screening only days before their wedding, social and emotional commitments are often irreversible, potentially biasing the high rate of marriage completion (76.9%).

-Data Scope: The longitudinal data for certain hemoglobin variants and advanced indicators (like HbA1c) were only introduced or systematically categorized in 2025, limiting the ability to perform a long-term trend analysis for those specific variables prior to that year.

2.9 Ethical Considerations

The study was conducted in accordance with international ethical standards for medical research involving human subjects. The following ethical measures were strictly implemented:

-Official Approvals: Formal administrative approvals were obtained from the Basrah Health Directorate and the management of the ten participating hospitals to access the premarital screening records and digital health databases.

-Informed Consent: For the retrospective cohort analysis (Part II), verbal informed consent was obtained from all high-risk couples before conducting the telephone interviews. Participants were informed about the purpose of the study and their right to decline participation without any consequences.

-Confidentiality and Data Privacy: All personal identifiers (such as names and phone numbers) were anonymized during the data analysis phase to ensure the privacy of the participants. Data was used strictly for scientific research purposes and were handled with high confidentiality to protect the social status of the individuals involved.

-Beneficence and Non-maleficence: The study aimed to improve public health outcomes by identifying gaps in the screening program without causing any psychological or social harm to the participants. During the interviews, the sensitivity of the genetic results was respected, ensuring that the process was supportive rather than intrusive



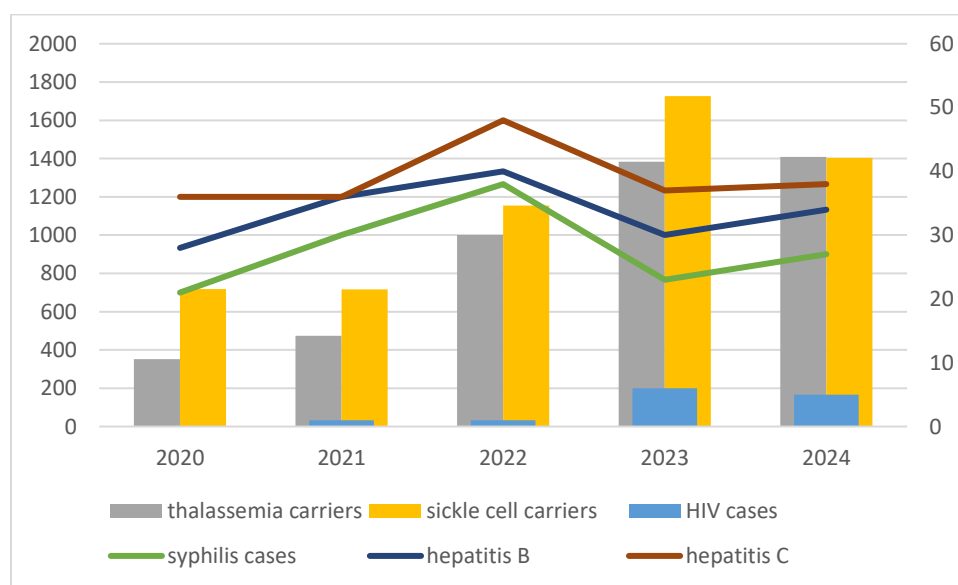


Results and Discussion

Table 3.1: Indicators of the Premarital Screening Program for the Years (2020,2021,2022,2023,2024)

The year	Total number	Number of positive thalassemia carriers	Number of positive sickle cell carriers	Number of HIV positive cases	Number of syphilis-positive cases	number of people infected with hepatitis B	number of people infected with hepatitis C
2020	43526	352	719	0	21	28	36
2021	55137	474	716	1	30	36	36
2022	52062	1001	1154	1	38	40	48
2023	50264	1384	1726	6	23	30	37
2024	51372	1408	1404	5	27	34	38

Source: Prepared by the researcher based on Basrah Health Directorate data



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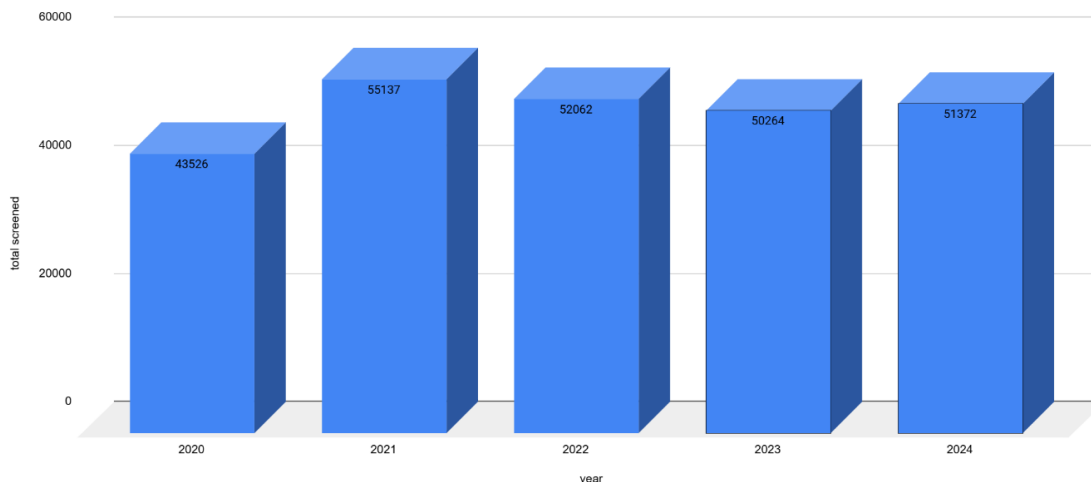
Figure 1: distribution of pathological and genetic cases (2020-2024)





Statistical trends showing a 33% increase in the number of individuals screened from 2020 to 2024, indicating a significant growth in program demand.

Figure (2): Statistical Trend of Premarital Screening Volume in Basrah, Highlighting Increased Public Demand



Source: Prepared by the researcher based on Basrah Health Directorate data

Figure (2): statistical trend of premarital screening volume in Basrah

This figure shows a high screening volume in Basrah, exceeding 50,000 individuals annually. This reflects strong community awareness but highlights the heavy workload on the current infrastructure.

Table 3.2: Clinics Integrated into the Electronic Project (Contracted)

No.	Health Institution Name	Availability of all Lab Tests	HPLC Device Type	Electronic Integration	Specialized Hematologist	Infrastructure Status
1	Al-Sadr Teaching Hospital	Yes	Bio Rad D10	Completed	Available	Fully Equipped
2	Al-Basrah Teaching Hospital	Yes	D10	Completed	Available	Fully Equipped
3	Al-Fayhaa Teaching Hospital	Yes	Bio Rad D10	Completed	Available	Fully Equipped
4	Al Mawani Teaching Hospital	Yes	D10 / Bio Rad	Completed	Available	Fully Equipped
5	Al-Zubair General Hospital	Yes	Bio Rad D10	Completed	Available	Fully Equipped
6	Al-Qurna General Hospital	Yes	Bio Rad D10	Completed	Available	Fully Equipped

Source: Prepared by the researcher based on Basrah Health Directorate data





This table includes the six main health facilities that are fully integrated into the electronic system and have completed their infrastructure updates

Table 3.3: Clinics Outside the Electronic Project (Non-Contracted)

No.	Health Institution Name	Availability of all Lab Tests	HPLC Device Type	Electronic Integration	Specialized Hematologist	Infrastructure Status
1	Al-Medainah General Hospital	No	Variant 2	Not Integrated	Not Available	Incomplete
2	Abi Al-Khasib General Hospital	No	D10	Not Integrated	Not Available	Incomplete
3	Al-Fao General Hospital	No	Bio Rad D10	Not Integrated	Not Available	Incomplete
4	Umm Qasr General Hospital	No	Bio Rad D10	Not Integrated	Not Available	Incomplete

Source: Prepared by the researcher based on Basrah Health Directorate data

This table includes the peripheral hospitals that currently rely on manual entries and have gaps in specialized staffing

Table 3.4: Comprehensive Statistical Results for Premarital Screening in 2025

No.	Examination / Test Type	Males Tested	Males Confirmed	Females (Tested)	Females (Confirmed)	Total Tested	Total Confirmed	Percentage (%)
1	Hemoglobin (Hb < 12 g/dL)	29,017	983	29,017	13,808	58,034	14,791	25.4%
2	Rh Negative (Rh -ve)	29,017	2,282	29,017	2,323	58,034	4,605	7.9%
3	Thalassemia (HbA2)	29,017	652	29,017	633	58,034	1,285	2.2%
4	Sickle Cell Trait (HbS)	29,017	1,297	19,379	357	48,396	1,654	3.4%
5	HbA1c (Diabetes Screen)	29,017	719	28,545	48	57,562	767	1.3%
6	HbC Variant	29,017	2	19,379	2	48,396	4	0.01%





7	HbD Variant	29,017	14	19,379	5	48,396	19	0.03%
8	Other Hb Variants	29,017	28	19,379	5	48,396	33	0.07%
9	HBsAg (Hepatitis B)	29,017	63	29,017	37	58,034	100	0.17%
10	Anti-HCV (Hepatitis C)	29,017	18	29,017	11	58,034	29	0.05%
11	Syphilis (TPHA)	29,017	23	29,017	10	58,034	33	0.06%
12	HIV (AIDS)	29,017	1	29,017	0	58,034	1	0.002%

Source: Prepared by the researcher based on Basrah Health Directorate data

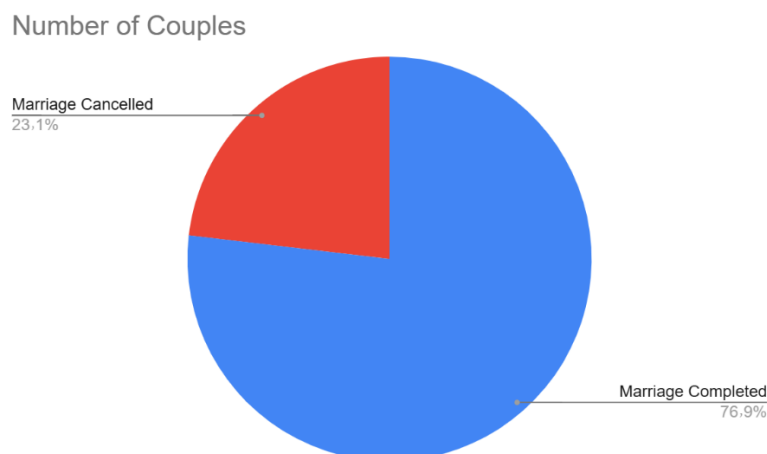
Table 3.5 Follow-up Statistics for Thalassemia Trait Carriers (Basrah 2025)

Month	Total Cases Registered	Calls Answered	No Response / Switched Off	Marriage Completed	Marriage Cancelled
January	21	17	4	11	6
February	29	24	5	21	3
March	17	13	4	9	4
April	24	17	7	14	3
May	29	24	5	23	1
June	15	13	2	13	0
July	19	16	3	9	6
August	15	10	5	7	4
September	25	21	4	18	3
October	33	29	4	21	8
November	22	19	3	13	6
December	33	26	7	17	9
Total	282	229	53	176	53

Source: Prepared by the researcher based on Basrah Health Directorate data

This table summarizes the outcomes of the follow-up phase for high-risk couples identified in 2025. It tracks the response rates to genetic counseling and the subsequent marital decisions, providing a quantitative basis for evaluating the program's impact on behavioral change within the Basrah community.





Source: Prepared by the researcher based on Basrah Health Directorate data

Figure (3): Behavioral outcomes of high-risk couples following genetic counseling in Basrah (2025).

The chart illustrates that 76.9% (176 couples) proceeded with marriage, while 23.1% (53 couples) opted for cancellation. This highlights the limited impact of late-stage screening on final marital decisions due to established socio-cultural commitments. The comprehensive analysis of the premarital screening (PMS) program in Basrah from 2020 to 2025 reveals significant epidemiological and operational trends. Starting with the longitudinal data, there has been a notable increase in the total number of screened individuals, rising from 43,526 in 2020 to a peak of 58,034 in 2025. This 33% increase in five years reflects both population growth and an enhanced public awareness of the necessity of premarital testing. Crucially, the detection of genetic blood disorders followed a sharp upward trajectory; Thalassemia carriers identified jumped from 352 in 2020 to 1,285 in 2025, while Sickle Cell trait carriers more than doubled, from 719 to 1,654 in the same period. This rise is likely attributed to the introduction of more precise diagnostic indicators and the expansion of screening outlets, rather than a sudden change in the genetic pool.

Regarding infectious and transmissible diseases, the results show fluctuating but generally controlled patterns. HIV cases remained exceptionally low, with only one case recorded in 2025, while Syphilis cases decreased significantly from 38 in 2022 to 33 in



2025. Similarly, Hepatitis B and C infections showed a downward trend toward 2025, suggesting a positive impact of national vaccination programs and public health interventions. These figures underscore the program's vital role as a first line of defense against the horizontal transmission of infectious diseases within the marital unit.

The infrastructure assessment of the ten major clinics in Basrah highlights a technological divide. While six main facilities including Al-Sadr Teaching Hospital, Al-Basrah Teaching Hospital, Al-Fayhaa teaching hospital, Al-Mawani teaching hospital and two outlets locating in the periphery (Al-Qurna general hospital, and Al-Zubair general hospital), are fully integrated into the electronic system and equipped with Bio-Rad D10 HPLC devices, other outlets, including four peripheral hospitals—Abi Al-Khasib, Al-Fao, Al-Medainah, and Umm Qasr General Hospitals, still lack electronic integration and specialized hematologists. This disparity in infrastructure readiness, particularly the reliance on manual record-keeping in 40% of the centers, poses a significant challenge for data accuracy and the real-time tracking of high-risk cases.

The laboratory results for 2025 reveal a significant prevalence of anemia, with 25.4% of the screened population exhibiting hemoglobin levels below 12 g/dL. This high percentage, particularly prominent among females (13,808 cases), suggests a substantial public health concern in Basrah. Such findings may be attributed to a combination of nutritional deficiencies and the high carrier rate of hereditary blood disorders like Thalassemia and Sickle Cell trait identified in the study area. This necessitates integrated public health strategies that address both nutritional education and early genetic screening to mitigate the burden of anemia within the community. Furthermore, the Rh-negative factor was confirmed in 7.9% of the population, necessitating early obstetric counseling for future pregnancies. Most critically, the screening identified 1,285 confirmed Thalassemia carriers (2.2%) and 1,654 Sickle Cell trait carriers (3.4%), forming the high-risk group that requires intensive genetic counseling.

The most significant finding regarding the program's preventive impact is the behavioral response of high-risk couples. Out of 229 couples who received follow-up, 23.1% (53 couples) opted for marriage cancellation. While this indicates that genetic counseling is successfully influencing nearly one-fourth of high-risk cases, the majority (76.9%) still proceed with the union. This suggests that in Basrah's socio-cultural context,





the emotional and social commitments established prior to the late-stage screening often outweigh the clinical warnings of a 25% risk of Thalassemia Major in offspring.

The findings of this study regarding the high rate of marriage completion (76.9%) among high-risk couples in Basrah are consistent with previous regional studies⁽²⁴⁾. For instance, a study conducted in Dohuk⁽²⁵⁾ reported similar behavioral outcomes, where social and emotional commitments often overrode medical warnings, leading to a low marriage cancellation rate. Furthermore, the longitudinal experience in Saudi Arabia⁽²⁶⁾, initially showed a very low marriage cancellation rate similar to the results found in Basrah (7.6%), although the Saudi program demonstrated that these figures improve over decades through intensive public awareness and policy support. This suggests that the socio-cultural context in Basrah plays a dominant role in the decision-making process.

Moreover, as emphasized by Al-Kindi⁽²⁾, the timing of the screening remains a critical failure factor for genetic counseling^(27,28,29). Since couples in Basrah usually undergo testing only days before the formal marriage contract, they find it socially and emotionally difficult to retract their commitment, a situation that aligns with the observations of this study. During the telephone follow-up interviews, one of the high-risk participants explicitly stated the prevailing social attitude toward the screening process, saying:

“We have already completed all wedding preparations and reached a final agreement on every detail. For us, these medical tests are merely a formal administrative procedure required to finalize the marriage contract in the Iraqi courts. The results will not change our decision; the marriage is going forward as agreed upon by both families”. This testimony reflects a critical systemic gap identified by the researcher in her administrative capacity. It suggests that the timing of the screening—usually occurred just days before the judicial procedures—is the primary reason for its low preventive impact. By the time the results are issued, the social cost of canceling the marriage in a community like Basrah is perceived as far greater than the clinical cost of potential genetic disorders. This reinforces the urgent need to shift toward pre-engagement screening to allow couples sufficient time



for informed decision-making before the social pressure of the wedding preparations becomes insurmountable^(30,31).

Summary of Results

The comprehensive evaluation of the Premarital Screening (PMS) program in Basrah (2020–2025) yielded the following key findings:

-Epidemiological Trends: There was a significant 33% increase in the number of screened individuals, rising from 43,526 in 2020 to 58,034 in 2025. In 2025 alone, the program identified 1,285 Thalassemia carriers (2.2%) and 1,654 Sickle Cell trait carriers (3.4%).

-Health Indicators: Laboratory results revealed a high prevalence of anemia (25.4%), particularly among females (13,808 cases). Conversely, infectious diseases like HIV and Syphilis remained controlled, with only one HIV case recorded in 2025.

-Infrastructure and Digital Readiness: A technological divide was identified; while 60% of centers (are fully integrated into an electronic system and equipped with Bio-Rad D10 HPLC devices, 40% of peripheral centers (such as Al-Fao and Umm Qasr) still rely on manual, paper-based entry systems.

- Impact of Genetic Counseling: Among the 282 high-risk couples identified in 2025, follow-up for 229 cases showed that 76.9% (176 couples) proceeded with their marriage despite receiving professional genetic counseling about the 25% risk to their offspring.

-Marriage Cancellation Rate: The program recorded a marriage cancellation rate of 23.1% (53 couples). While this indicates a measurable impact of genetic counseling, it also shows that for most cases, social and emotional commitments still override medical advice due to the late timing of the screening.

Conclusion

The findings of this study, viewed through the lens of both clinical research and administrative oversight within the Basrah Health Directorate, lead to several critical conclusions:

1. **Administrative and Technological Divide:** There is a clear correlation between the efficiency of the program and the level of digital integration. The 40% of centers





- still operating on manual systems represent a significant administrative bottleneck, leading to data fragmentation and delaying the potential for real-time preventive intervention.
2. **The Counseling-Behavioral Paradox:** As the manager of the program, it is evident that while the diagnostic phase is highly standardized, the preventive outcome is compromised. The high rate of marriage persistence (76.9%) among high-risk couples, despite professional counseling, confirms that clinical advice is often overshadowed by late-stage social commitments.
 3. **Operational Timing as a Barrier:** My direct involvement in follow-up interviews revealed that the primary reason for program failure in its preventive goal is the timing of the screening. Most couples undergo testing at a point where the emotional and financial costs of cancellation are perceived as higher than the long-term genetic risks.
 4. **The Need for Systemic Shift:** From an administrative standpoint, the current model of premarital screening in Basrah functions more as a documentation formality than a prevention tool. Transitioning toward a centralized digital registry and implementing earlier screening initiatives (e.g., at the university or high school level) is no longer a luxury but a necessity to ensure the sustainability of public health resources.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are proposed to enhance the effectiveness of the Premarital Screening (PMS) program in Basrah:

- 1-**Strengthening Genetic Counseling Services:** It is essential to establish dedicated, private counseling rooms within all PMS centers. This ensures confidentiality and creates a suitable environment for health providers to communicate sensitive genetic risks effectively to high-risk couples.
- 2-**Upgrading Laboratory Infrastructure:** All screening outlets should be equipped with advanced and standardized diagnostic technologies, such as HPLC (High-Performance





Liquid Chromatography) or Capillary Electrophoresis. Providing a continuous supply of reagents is crucial to minimizing technical errors and prevent delays in issuing results.

3-Establishing a Central Reference Laboratory: To resolve ambiguous results from the D-10 analyzers, a central reference laboratory should be established or empowered. This facility would act as a final verification point before providing definitive counseling to couples, ensuring the highest level of diagnostic accuracy.

4-Implementing a Unified Electronic Database: Accelerating the digital transformation by linking all ten centers in Basrah through a unified electronic system is vital. This will facilitate real-time data tracking, improve the follow-up of high-risk cases, and prevent the loss of medical records.

5-Promoting Pre-Engagement Screening: Public health authorities should launch educational campaigns to shift the societal norm from pre-marriage screening to pre-engagement screening. Testing at an earlier stage, before social and emotional commitments are finalized, allows couples more freedom to make informed decisions.

6-Capacity Building and Training: Regular training programs should be organized for physicians and genetic counselors. These programs should focus on advanced communication skills and psychological support to better influence the decision-making process of carrier couples.

7-Future Longitudinal Research: Further research is recommended to track the long-term health outcomes of children born to high-risk couples who decided to proceed with marriage. This data will be instrumental in measuring the future burden on Basrah's healthcare system.

8. Institutionalizing Routine Student Screening: It is strongly recommended to integrate Thalassemia and Hemoglobinopathy screening as a mandatory, routine component of the school health examination system (specifically for intermediate or secondary school students). Identifying the genetic carrier status at an early developmental stage, long before any emotional or social commitments are formed, is the most effective strategy to ensure informed future decision-making and to bypass the socio-cultural pressures associated with late-stage premarital testing.

9. Legislative and Judicial Support: The study suggests collaborating with the judicial system to require high-risk couples (identified through the screening) to attend an Intensive





Genetic Counseling Certificate program as a prerequisite for issuing a marriage contract. This ensures that the final decision to proceed with marriage is based on a documented and comprehensive understanding of the medical, financial, and psychological consequences for their future offspring.

10. Educational Curriculum Integration: To address the high prevalence of anemia (25.4%) and the general gap in genetic literacy, public health topics related to hereditary blood disorders should be incorporated into the national educational curriculum. This proactive educational approach aims to foster a preventive health culture from a young age, reducing the reliance on last-minute medical interventions.

11. Launching Targeted Nutritional Awareness Programs for Prospective Brides: Given the high prevalence of anemia among females in Basrah, which significantly exceeds that of males (as evidenced in Table 3.4), it is recommended to design intensive educational and nutritional programs specifically for women in the premarital stage. These programs should focus on correcting dietary habits, raising awareness about the importance of iron and folic acid supplementation, and explaining the impact of anemia on future reproductive health and fetal development, ensuring that prospective mothers enter pregnancy in optimal health.

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