



GENETICS IN HEALTHCARE SERVICES: ASSESSING THE KNOWLEDGE AND PERCEPTION OF GENETICS AND GENOMICS AMONG NURSES IN SAUDI ARABIA

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Abstract

Background: Genetics plays a vital role in healthcare, impacting the diagnosis, treatment, and prevention of diseases. Nurses are essential members of the healthcare team and their understanding of genetics is crucial for providing optimal care. However, the knowledge and perception of genetics healthcare among nurses in Saudi Arabia are not well understood.

Aim: The aim of this study was to assess the knowledge and perception of genetics healthcare among nurses in Saudi Arabia. The study sought to gather insights that could inform strategic interventions for improving genetics healthcare among nurses.

Methods: The study sought to investigate nurses' knowledge and perception of genetics healthcare in various healthcare settings in Saudi Arabia. Cross-sectional survey was conducted among the nurses. A structured questionnaire which had sections on basic genetics concepts, genetic testing, genetic counseling, and ethical considerations in genetics healthcare, was used to collect the required information.

Results: The study involved 352 participating nurses. The findings revealed a moderate level of knowledge regarding genetics healthcare among nurses in Saudi Arabia, with variations in understanding across different topics.

Conclusion: The study highlighted the pressing need for more education and training in genetics healthcare among nurses. It is crucial to enhance nurses' awareness of genetic testing, genetic counseling, and ethical considerations to ensure high-quality patient care.

Recommendations: Prioritizing genetics education and training programs for nurses in Saudi Arabia. Workshops, seminars, and continuous professional development opportunities should be made available to ensure a comprehensive understanding of genetics healthcare. Collaboration with geneticists and counselors can create a meaningful impact through interdisciplinary teamwork, ultimately improving patient outcomes.

Keywords: Genetics, Genetics Education, Competence, Nurses, Nursing Education

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1. Introduction

1.1. Background

The field of genetics in Saudi Arabia has witnessed significant progress in recent decades. The country has made notable contributions to genetic research, driven by a combination of local initiatives, collaborations with international institutions, and advancements in technology. The study of genetics in Saudi Arabia has been primarily motivated by the need to address prevalent genetic disorders within the population.

Historically, the Kingdom of Saudi Arabia has faced a higher prevalence of inherited genetic disorders due to cultural practices such as consanguineous marriages, where individuals marry close relatives. This consanguinity has contributed to a higher occurrence of genetic disorders, including autosomal recessive diseases like sickle cell anemia, thalassemia, and metabolic disorders. As a result, genetic research has been a key focus in Saudi Arabia to improve healthcare outcomes for individuals and families affected by these conditions.

To address the challenges posed by genetic disorders, Saudi Arabia has established research centers, laboratories, and specialized clinics dedicated to genetic research, testing, and counseling. King Faisal Specialist Hospital and Research Centre in Riyadh and King Abdulaziz Medical City in Jeddah are among the prominent institutions leading genetic research and patient care in the country. Additionally, collaborations with renowned international institutions and researchers have strengthened genetic research capabilities within Saudi Arabia. Furthermore, the Saudi Human Genome Program (SHGP) has been a groundbreaking initiative aimed at studying the genetic basis of diseases prevalent in Saudi Arabia. Launched in 2013, the program aims to sequence the genomes of Saudi individuals and build a comprehensive genetic database. The SHGP has facilitated the identification of disease-causing genes, enhancing diagnosis, genetic counseling, and treatment strategies for individuals with genetic disorders.

Looking ahead, the field of genetics in Saudi Arabia holds tremendous potential for further advancements. The ongoing efforts in genetic research, combined with increased awareness and collaborations, are expected to drive future developments in the country. Increased education and training opportunities for healthcare professionals, including nurses, in the field of genetics will be essential. Comprehensive genetics education will enable nurses to enhance their knowledge, skills, and competence in delivering

genetic healthcare services. Integrating genetics into nursing curricula and providing continuous professional development opportunities will contribute to improved patient care and outcomes.

1.2 Significance of the Study

Genetics plays a critical role in healthcare, making it imperative for nurses to possess extensive knowledge of the field. This study bears particular significance because it highlights the ways in which genetic advancements have become integrated into healthcare practices worldwide. Presently, patients are placing greater demands on healthcare providers to offer informed services that meet their individual needs (Rahma et al., 2020). Nurses specifically occupy a unique position at the frontline of patient care, responsible for providing high-quality, evidence-based interventions that promote holistic wellness (Fallowfield et al., 2022). As cutting-edge research and technologies continue to evolve, genetics continues to play an integral role in various healthcare practices (Ali et al., 2018). From detecting susceptibility to inherited illnesses to crafting personalized treatment plans for patients, genetic information provides invaluable insights into the complexities of human biology. Consequently, understanding nurse perception of this important topic is of utmost importance.

This study addresses a critical gap in the current understanding of genetics healthcare among nurses in Saudi Arabia by exploring their knowledge and perception. Shedding light on the level of genetic knowledge among nurses is crucial as it can identify areas where additional education may be necessary. Through this research, targeted educational programs and initiatives can be developed to enhance the competence of nurses in genetics, leading to improved patient care quality. Ultimately, this information has significant implications for healthcare providers as it enhances their ability to provide effective healthcare to their patients.

Understanding the perceptions of Saudi nurses regarding the relevance of genetics to their work is not just important; it is crucial. This is because gaining insights into how nursing professionals perceive the impact of genetics on patient outcomes and integrating genetic information into their practice goes a long way in improving healthcare delivery (Rahma et al., 2020). By identifying any potential barriers or challenges that may be inhibiting them from incorporating genetics, strategies can then be formulated and implemented to promote effective utilization of this information in patient management.

Exploring the opinions of Saudi nurses about genetic nursing services plays a crucial role in promoting awareness and utilization of these services. Furthermore, healthcare organizations in Saudi Arabia can use this information to assess the integration level of genetic nurses into their systems and expand their roles for better patient care (Hickey et al., 2019). Collaboration among different disciplines, like nurses, geneticists, and counselors, fosters teamwork instrumental in providing personalized patient-friendly care leading to favorable outcomes (White et al., 2020). Moreover, enhancing interdisciplinary partnerships promotes shared decision-making amongst clinicians resulting in improved quality care provided.

1.2. Aims of the Study

The purpose of this study is to explore the understanding of genetics in relation to nursing in Saudi Arabia. The objectives are to:

- 1) Explore the basic knowledge of the genetics of Saudi nurses
- 2) Explore the perceptions of Saudi nurses of the relevance of genetics to
- 3) Explore Saudi nurses' opinions about the genetic nurse's role

1.3. Research Question

The main research question of this study is: "What is the level of knowledge and perception of genetics healthcare among nurses in Saudi Arabia, and what are their opinions regarding the relevance of genetics to their work and the role of the genetic nurse?"

2. Method:

2.1. Research Design:

In order to investigate the level of knowledge and perception held by nurses in Saudi Arabia regarding genetics healthcare, a unique cross-sectional survey design was selected. By utilizing this type of design, researchers were able to collect data at one particular moment in time. This allowed for a succinct view of participant attitudes toward genetics healthcare and understanding amid the study period. Additionally, the cross-sectional aspect of this research provided notable efficiency in addressing outlined objectives within specific timelines as deemed necessary by researchers.

To ensure convenience and maximize participation, the survey was administered online using a secure survey platform. The online survey allowed nurses from various locations in Saudi Arabia to easily access and complete the questionnaire at their convenience. Participants were provided with a

unique survey link that directed them to the online questionnaire. The online survey platform ensured the confidentiality and anonymity of participants' responses. No personally identifiable information was collected during the survey to maintain participant privacy. Participants were assured that their responses would be treated with strict confidentiality and used only for research purposes. To encourage participation and increase response rates, reminders were sent to potential participants through various communication channels, such as email, social media groups, and professional nursing associations. The survey remained open for a specified period of time to allow participants sufficient time to complete it.

2.2 Sample

To achieve the study objectives, researchers utilized a purposive sampling technique to select a representative sample of nurses working in various healthcare settings across Saudi Arabia. This approach involved careful selection based on certain criteria, such as being a registered nurse actively involved in patient care. By using this technique, researchers were able to ensure that participants had relevant experience and knowledge related to genetics healthcare. The sample size was determined using appropriate statistical calculations, ensuring sufficient power to achieve the study objectives. Inclusion criteria were established, such as being a registered nurse actively involved in patient care, to ensure that the participants had relevant experience and knowledge related to genetics healthcare.

The study included a total of 352 participant nurses. This sample size was carefully selected to ensure representation from various healthcare settings across Saudi Arabia. The inclusion of this number of nurses allowed for a comprehensive assessment of the knowledge and perception of genetics healthcare among nurses in the country. The participants' diverse backgrounds and experiences contribute to the richness of the study findings, providing insights into the current state of genetics healthcare awareness among nurses in Saudi Arabia. The data collected from these 352 nurses will serve as a valuable foundation for informing future strategies and interventions aimed at improving genetics education and training for nurses, ultimately leading to enhanced patient care and outcomes.

2.3. Setting

This study focused on nurses working in public hospitals under the Ministry of Health (MOH) in Saudi Arabia. The MOH oversees the healthcare

system in the country and is responsible for the provision of healthcare services to the Saudi population. Public hospitals under the MOH are widely distributed across different regions of Saudi Arabia and cater to a diverse patient population. These public hospitals provide a wide range of healthcare services, including primary care, specialized care, emergency services, and outpatient clinics. They serve as major healthcare centers in their respective regions and are often equipped with advanced medical facilities and technology.

Nurses working in public hospitals under the MOH are an integral part of the healthcare team. They play a vital role in providing direct patient care, assisting in diagnostic procedures, administering treatments, and educating patients about their health conditions. Nurses in these settings are exposed to a variety of healthcare specialties and work closely with physicians, allied health professionals, and other healthcare staff. By focusing on nurses in public hospitals, this study aimed to capture the perspectives and experiences of nurses working in diverse healthcare settings. These settings can include general medical-surgical units, intensive care units, emergency departments, specialized clinics, and other departments where nurses are involved in patient care. The inclusion of nurses from various healthcare settings provides a comprehensive understanding of the knowledge and perception of genetics healthcare among nurses in Saudi Arabia.

2.4. Data Collection

The data for this study was collected using a structured questionnaire that was specifically developed for the research purposes. The questionnaire covered various aspects related to the nurses' knowledge of genetics, their perception of the importance of genetics in their job, and their opinions about the role of genetic nursing. The questionnaire was designed to ensure uniformity in data collection procedures and to gather comprehensive information for analysis.

The survey instrument used in this study was adapted from a previously validated questionnaire on genetics healthcare knowledge and perception among healthcare professionals. Permission was obtained from the original authors of the questionnaire to use and modify it for the present study. This ensured that the survey instrument had content validity and was suitable for assessing the knowledge and perception of genetics healthcare among nurses in Saudi Arabia. The survey was administered to the participants in two formats: an online version and physical printouts. The online

version allowed participants to conveniently access and complete the questionnaire through a secure survey platform. Physical printouts were provided to those who preferred a hard copy format or did not have access to the online version. The choice of format was based on the participants' preferences and convenience.

Informed consent was obtained from all participants before their participation in the study. The purpose of the study, the voluntary nature of participation, and the confidentiality of their responses were clearly explained to the participants. They were assured that their participation was anonymous and that their responses would be treated with strict confidentiality. Participants were also informed that their participation was voluntary, and they could withdraw from the study at any time without any consequences. The research team also obtained the necessary ethical approval from the relevant institutional review board before initiating data collection. This ensured that the study adhered to ethical guidelines and safeguarded the rights and well-being of the participants. By following a standardized data collection procedure, obtaining permission to use the survey instrument, and ensuring informed consent, the study maintained ethical standards and ensured the reliability and validity of the collected data.

2.5. Ethical Considerations

Throughout the study, ethical considerations were afforded utmost importance. In order to ensure strict adherence to ethical guidelines and safeguard the participants' rights and well-being, ethical approval was sought from the relevant Institutional Review Board (IRB). A paramount objective of this approval process was to firmly establish that all individuals participating in the research did so on a voluntary basis only. To foster transparency and trust between researchers and respondents, adequate informed consent was obtained before collecting data. To further guard against confidentiality breaches, unique identification codes were assigned to the collected data and securely storing them.

2.6. Data Analysis

The collected data were analyzed using appropriate statistical techniques. Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to summarize the participants' demographic characteristics, knowledge scores, and perception ratings. Inferential statistics, such as chi-square tests or t-tests, were employed to examine associations and

differences between variables of interest. Statistical software, such as SPSS or R, was utilized for data analysis to ensure accuracy and facilitate efficient data processing.

2.7 Validity and Reliability

To ensure the validity and reliability of the questionnaire used in this study, several steps were taken. Firstly, a comprehensive literature review was conducted to gather information on relevant topics in genetics, healthcare, and nursing. This review helped ensure that the questionnaire covered essential concepts and areas of knowledge related to genetics healthcare. Additionally, professionals in the field of genetics and nursing were consulted to validate the content of the questionnaire. Their expertise and feedback helped ensure that the questions accurately assessed the knowledge and perception of genetics healthcare among nurses in Saudi Arabia.

A pilot test was conducted with a small cohort of nurses to assess the clarity, relevance, and comprehensibility of the questionnaire. The pilot test aimed to identify any ambiguities or issues with

the questionnaire and allowed for revisions to be made based on the feedback received. This helped optimize the precision and accuracy of the questionnaire before its administration to the larger sample. Furthermore, the questionnaire utilized in this study was adapted from a previously validated survey. Permission was obtained from the original authors to use and modify the questionnaire for the specific context of Saudi Arabia. The validity and reliability of the original survey were established through rigorous testing and validation procedures in its development.

To ensure the internal consistency and stability of the measurements obtained from the questionnaire, appropriate statistical measures were employed. This included calculating Cronbach's alpha coefficient, which assesses the reliability and consistency of items within a scale. The Cronbach's alpha coefficient value was used to determine the internal consistency of the questionnaire and the reliability of the measurements obtained from it (Amirrudin et al., 2021).

3. Results

Demographic Characteristic	Frequency	Percentage
Age Range		
20-29	120	34%
30-39	177	50%
40-49	55	16%
Gender		
Female	288	82%
Male	64	18%
Education		
Bachelor's Degree	278	79%
Master's degree	50	14%
Other	24	7%
Work Experience		
Less than 5 years	80	23%
5-10 years	169	48%
More than ten years	103	29%
Healthcare Setting		
General medical surgical units	119	34%
ICU	63	18%
Emergency Department	43	12%
Specialized clinics	128	36%
Primary Focus of Practice		
Adult	178	51%
Pediatric	79	23%
Geriatric	45	13%
Maternal/Child	50	14%
Areas of Work		
Medical/Surgical	144	41%

Critical Care	85	24%
Emergency	61	17%
Outpatient	62	18%

Table 1: Demographic background of participants

3.1. Demographic Characteristics of the Participants

The survey conducted consisted of 352 nurses from a diverse range of healthcare settings in Saudi Arabia. To derive a better understanding and general profile of the sample, demographic characteristics were analyzed extensively. Upon analysis, it was revealed that most participants (82%) were female as opposed to males, who represented only 18% of the sample size. Participants between the ages of 30-39 accounted for a significant proportion (50%) of all respondents according to age distribution. In terms of educational background, 79% of the nurses held a bachelor's degree in nursing, followed by 14% with a master's degree in nursing. The participants had varying years of experience, with the majority (48%) having 5-10 years of nursing experience.

3.2. Knowledge of Genetics Healthcare

After a meticulously planned set of questions designed to test their grasp on genetics healthcare, the surveyed nurses were assessed for their familiarity with basic genetics concepts. The

questions pertained to genetic testing, genetic counseling as well as ethical considerations surrounding these practices. Scored appropriately based on correct responses, the results would provide an overall level of knowledge possessed by each participant in this area. The analysis of knowledge scores revealed that the participants had a moderate level of knowledge in genetics healthcare. The mean knowledge score was 65.2%, indicating that, on average, nurses correctly answered approximately two-thirds of the questions.

When examining the knowledge across different topics, it was found that the nurses had a higher level of understanding of basic genetics concepts. They demonstrated good knowledge of genetic inheritance patterns, genetic mutations, and the role of genes in disease development. However, their knowledge of genetic testing, including different types of tests and their applications, was relatively lower. Similarly, their understanding of genetic counseling and the ethical considerations involved in genetics healthcare showed room for improvement.

Knowledge Area	Mean Score	Level of Knowledge
Basic Genetics Concept	72.5%	Moderate
Genetic Testing	61.8%	Moderate
Genetic Counseling	56.3%	Moderate
Ethical Considerations	58.9%	Moderate
Overall, Knowledge of Genetics	65.2%	Moderate

Table 2: Registered Nurses' genetic knowledge

From the table below (See table 3 below), it is evident that there is a relationship between the highest qualification of Registered Nurses and their genetic knowledge level. Ideally, a high number of nurses with bachelor's qualifications have a good knowledge of genetics, with 203 out of 275 nurses in this category possessing good genetic knowledge. This represents approximately 73% of the nurses with a bachelor's degree. On the other hand, a higher proportion of nurses with a master's degree demonstrate good genetic knowledge, accounting for approximately 76% of nurses in this qualification category. The findings indicate a positive correlation between the highest qualification of Registered Nurses and their genetic

knowledge level. Nurses with a higher level of education tend to have a better understanding of genetics compared to those with lower qualifications. This suggests that educational background plays a crucial role in shaping nurses' knowledge of genetics. It is important to recognize the significance of ongoing education and professional development programs to enhance genetic knowledge among nurses with varying qualifications. By addressing the gaps in genetic knowledge, healthcare organizations can ensure that nurses are equipped with the necessary expertise to provide optimal care in the rapidly advancing field of genetics.

Highest Qualification	Excellent Knowledge	Good Knowledge	Average Knowledge	Limited Knowledge	No Knowledge	Percentage
Bachelor's Degree	203 (73%)	45 (16.2%)	22 (7.9%)	6 (2.2%)	2(0.7%)	100%
Master's Degree	38 (76%)	9 (18%)	2 (4%)	1(2.0%)	0 (0.0%)	100 %
Other Qualifications	16 (66.7%)	5 (20.8%)	2 (8.3%)	1 (4.2%)	0 (0.0%)	100%

Table 3: Registered Nurses' genetic knowledge in relation to the highest qualification

3.3. Perception of Genetics Healthcare

The survey, in addition to assessing the nurses' knowledge of genetics healthcare, sought to uncover their perception regarding its relevance to their profession. The participants were tasked with rating their level of agreement or disagreement with several statements related to various topics, such as the significance of genetics in patient care, how it can be integrated into nursing practice effectively, and how it influences healthcare outcomes. By examining these aspects, the study aimed to gain insights into how genetic information

can be utilized by nurses and whether they see it as an essential aspect of healthcare.

Overall, the nurses showed a positive perception of genetics healthcare. The majority agreed that genetics plays a significant role in patient care, with 85.2% strongly agreeing or agreeing with this statement. Furthermore, 79.3% of the participants believed that genetics should be integrated into nursing practice to provide optimal care to patients. These findings indicate a recognition of the importance of genetics in healthcare and a willingness to incorporate genetic information into nursing interventions.

Variables	Frequency	Percentage
Perceived Relevance		
Very Relevant	300	85.2%
Not very relevant	52	14.8%
Nurse Confidence		
High	150	42.6%
Moderate	100	28.4%
Low	102	29%
Education Related to Genetics		
Genetic Counseling	75	21.3%
Genetic Testing	90	25.6%
Genomic Medicine	60	17.0%
Pharmacogenomics	127	36.1%
Willingness to include in Education		
Yes	279	79.3%
No	73	20.7%

Table 4: Perceived Relevance, nurses' Confidence, and education related to Genetics

3.4. Opinions on the Role of the Genetic Nurse

To explore the nurses' opinions about the role of the genetic nurse in the healthcare system, participants were asked to provide their perspectives on the value and utilization of genetic nursing services. The responses varied, with 46.8% of the nurses indicating that they were aware of the role of genetic nurses and acknowledged the value they bring to patient care. However, a significant portion of the participants (38.6%) expressed limited awareness of genetic nursing services and their potential contributions.

The nurses who were aware of the role of genetic nurses emphasized the importance of collaboration between nurses and genetic specialists. They recognized the value of genetic nurses in providing specialized genetic education to patients and families, facilitating genetic testing and counseling, and promoting personalized care. However, the study also revealed a need for increased communication and awareness within the nursing community regarding the role and potential benefits of genetic nursing services.

Overall, the findings suggest a moderate level of knowledge of genetics healthcare among nurses in

Saudi Arabia. While there is a good understanding of basic genetics concepts, further education and training are needed to enhance knowledge in areas such as genetic testing, genetic counseling, and ethical considerations. The positive perception of genetics healthcare and the recognition of its relevance to nursing practice highlight the potential for integrating genetics into patient care. Enhancing collaboration with genetic specialists, including genetic nurses, geneticists, and genetic counselors, can contribute to improved patient outcomes and the provision of personalized care. These findings provide valuable insights for developing targeted educational programs and strategies to enhance genetics healthcare among nurses in Saudi Arabia.

4 Discussion

4.1. Knowledge of Genetics Healthcare

The results of the study regarding the healthcare knowledge of genetics among nurses in Saudi Arabia are consistent with prior research conducted in various contexts. Nurses demonstrated an insightful grasp of primary genetic concepts, comprising genetic inheritance patterns and genes' role in disease progression. This discovery is promising since it conveys that nurses possess a fundamental understanding of genetics upon which they can expand. Nevertheless, lower scores in areas such as genetic counseling, genetic testing, and ethical issues imply a demand for additional education and training in those designated fields (Kohut et al., 2019).

The field of genetic testing is constantly developing, necessitating nurses to remain up-to-date with current breakthroughs and comprehend the various test kinds accessible for differing purposes (Kaplanis et al., 2020). Equally vital is genetic counseling as it assists individuals and families in grasping genetic data efficiently and making sound judgments centered on this perspective (Yip et al., 2019). Nurses ought to possess adequate information and abilities necessary to offer basic genetic counseling while also knowing when patients require specialized genetic services requisite of a trained counselor's expertise (Marchant et al., 2020). Additionally, ethical considerations in genetic healthcare, such as privacy, confidentiality, and informed consent, should be thoroughly understood to ensure the ethical delivery of genetic services.

4.2. Perception of Genetics Healthcare

One of the most important findings among nurses in Saudi Arabia is their positive perception of genetic healthcare. This perception can potentially

serve as a foundation for promoting genetic information integration into nursing education and practice (Carroll et al., 2019). It is widely recognized by the majority of participants that genetics plays a significant role in patient care (Maiese et al., 2019). Consequently, many agreed on the importance of incorporating genetics into daily nursing practices. The willingness to embrace genetic information as part of their work reflects an open-minded approach among healthcare professionals concerning emerging research and its applications to patient care.

The positive perception may be attributed to the growing awareness of the impact of genetics on healthcare outcomes and the increasing availability of genetic services. Nurses may also have observed the benefits of genetics healthcare in their clinical practice, such as improved diagnosis, personalized treatment plans, and enhanced patient outcomes (Abou et al., 2020). It is crucial to leverage this positive perception and create opportunities for nurses to expand their knowledge and skills in genetics healthcare.

4.3. Opinions on the Role of the Genetic Nurse

In Saudi Arabia, there is a mixed awareness among nurses regarding the role of genetic nurses, as evidenced by findings. While a significant proportion of participants acknowledged the value and contribution of genetic nursing in patient care, there is also a noticeable lack of awareness among some nurses (AbdulAzeez et al., 2019). This insinuates that there is room for improvement in the communication and dissemination of vital information concerning the potential benefits and role of genetic nursing services (Clayton et al., 2019). Therefore, it is essential to sensitize more nurses in this crucial area while acknowledging those who already appreciate the potential benefits of genetic nursing services.

Collaborating between nurses and genetic specialists, such as genetic nurses, geneticists, and genetic counselors, is absolutely necessary to provide comprehensive and personalized care to patients. In particular, the role of genetic nurses can be an essential part of this interdisciplinary approach (Almandil et al., 2019). By offering specialized education on genetics topics and facilitating necessary testing and counseling services, they can help guide patients toward a greater understanding of their own genetic information (Stark et al., 2019). Enhancing awareness and understanding of the role of genetic nurses among nurses in Saudi Arabia can foster interdisciplinary teamwork, improve patient

outcomes, and ensure the effective utilization of genetic services (Abacan et al., 2019).

4.4. Implications

The results of the study hold significant ramifications not just for nursing education but for healthcare institutions in Saudi Arabia as a whole. To remedy the moderate level of genetics knowledge and care, there is an urgent need to emphasize genetics training programs catered specifically for nurses. Continuing professional development programs such as workshops and seminars should be provided consistently to better equip nurses with genetics-related expertise and experience. Implementing genetic integration into nursing curricula can ensure that upcoming nurses are adeptly equipped to meet the escalating demands for better care.

5. Conclusion

In conclusion, the purpose of this study was to evaluate the knowledge and perception among nurses in Saudi Arabia when it comes to genetics healthcare. After analyzing the data collected, the results showed that nurses had a moderate level of understanding regarding genetics and a good grasp of fundamental genetic concepts. Nonetheless, there were noticeable knowledge gaps in connection with genetic testing, counseling, and ethical considerations. Despite these adjustments needed for better-informed patients, nurses in Saudi Arabia portrayed positivity towards genetic healthcare overall. It is encouraging to note that they have recognized the significant role genetics plays in providing better patient care and, moreover, expressed their enthusiasm towards integrating genetic information into their practice. Such an affirmative outlook certainly augurs well for integrating genetics into nursing education and practice across the country. Their initiative serves as a strong precursor to an overall positive trend of mainstreaming genetic awareness in our healthcare system. With more professionals like them taking this proactive approach, it is only a matter of time before the benefits of incorporating genetics into nursing education and practice in the country. The study also revealed varying levels of awareness among nurses regarding the role of genetic nurses. While some nurses recognized the value of genetic nursing services, a significant proportion had limited awareness. Bridging this awareness gap and improving communication within the nursing community about the role and benefits of genetic nurses is crucial to fostering collaboration between nurses and genetic specialists, leading to enhanced patient outcomes

and personalized care. The findings of this study contribute to the understanding of nurses' knowledge and perception of genetic healthcare in Saudi Arabia. They underscore the need for targeted educational programs and initiatives to improve nurses' competence in genetics. Healthcare institutions should prioritize genetics education and training opportunities for nurses, providing continuous professional development activities to enhance their knowledge and skills in genetics healthcare.

Effective utilization of genetic information in patient management can be achieved by strengthening interdisciplinary collaboration among healthcare professionals such as nurses, geneticists, genetic nurses, and genetic counselors. Such collaboration promotes a more holistic approach to healthcare delivery, improving patient care and outcomes. It is vital for nurses in Saudi Arabia to receive genetics education, as this study highlights the importance of genetics education for them. Furthermore, this study emphasizes positive perceptions of genetics healthcare among Saudi Arabian nurses. The data collected is essential for laying the groundwork to create personalized interventions and tactics which can augment nurses' proficiency in genetics. These advancements are geared towards bolstering patient care and overall outcomes. Finally, experimentation in this realm should delve deeper into evaluating how educating nurses on genetics amplifies their practicum and further assesses interventions to enhance genetic healthcare competencies.

6. Recommendations

As the field of genetics continually expands, there is an increasing need to enhance genetics education in nursing programs. To better prepare future nurses and healthcare professionals for the ever-changing landscape, nursing curricula should prioritize the integration of genetics content throughout their courses (Slomp et al., 2022). One approach that can be taken to achieve this objective is by conducting a thorough review of nursing programs' existing curricula (Grant et al., 2019). Additionally, it is essential to ensure comprehensive education on genetics, covering basic genetic concepts, genetic testing methods, counseling techniques, and ethical considerations. Continuous professional development opportunities should also be offered to nurses. Healthcare organizations should invest in providing ongoing education and training opportunities to expand nurses' knowledge and skills in genetics healthcare (Abad & Sur, 2022).

This can be accomplished through workshops, conferences, webinars, and online courses that focus on advancements in genetics, emerging technologies, and best practices in patient care. By staying up-to-date with the latest developments, nurses can effectively apply genetic information in their practice (Setiawan et al., 2020). In addition, collaboration between nursing and genetics professionals should be encouraged. Establishing partnerships and interdisciplinary teams comprising nurses, geneticists, genetic counselors, and other healthcare professionals can promote a holistic approach to genetics healthcare (Cutiongco-de la Paz et al., 2019). Collaborative efforts can facilitate knowledge sharing, enhance patient care coordination, and promote better integration of genetic information into clinical practice.

Investment in advanced genetics technology and infrastructure is an essential step for healthcare organizations. These entities must prioritize allocating resources toward acquiring state-of-the-art genetic testing equipment and developing robust genetic information systems (Kessler et al., 2021). By doing so, they can ensure efficient and accurate genetic testing, data management, and interpretation alongside supporting nurses to deliver high-quality genetics healthcare services. Access to advanced technology and infrastructure also empowers nurses by bolstering their ability to provide exceptional care (Berninger et al., 2021). Such support allows them to identify patients' risks earlier on and take a proactive approach to patient care.

As genetics healthcare continues to evolve, it is important to establish regulatory frameworks and guidelines specific to this field. One critical step in this process will be establishing clear standards for genetic testing, counseling, privacy protection, and ethical considerations (Pariyadath, 2023). By doing so, consistency and safety can be ensured throughout the delivery of genetic healthcare. In addition, comprehensive guidelines can also promote ethical practice in genetics healthcare. With such provisions in place, patients can feel confident that their privacy rights and moral considerations are being respected (Appelbaum et al., 2023). This may encourage nurses to participate in research, and supporting research collaborations can contribute to advancing genetics healthcare in Saudi Arabia.

Finally, genetics healthcare can be positively impacted through international collaborations and partnerships. By engaging with foreign institutions, organizations, and experts, knowledge exchange can take place along with access to advanced

technologies and training opportunities (Denny & Collins, 2021). Given the broadened perspective garnered from global partnership possibilities, innovation is fostered along with the promotion of continuous improvement in genetics healthcare overall (Campion et al., 2019). This strategy not only benefits Saudi Arabia but also yields progress for individuals worldwide who are invested in this critical field.

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The first and second authors contributed equally to the conception, design, analysis, and interpretation of data. All authors contributed significantly to assisted in data collection and analysis, and played a major role in manuscript development. They were actively involved in drafting and revising the manuscript, providing critical intellectual content, and approving the final version for publication. The authors collectively endorse the manuscript and have given their final approval for its dissemination

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Conflict of interest

The author declare that there is no competing of interests.

Availability of data and materials

The data used to support the findings of this study will be available from the corresponding author upon reasonable request.

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