Competencies, Attitudes and Knowledge of Nurses about Genetics and Genomics at Maternal and Child Health Centers at Tanta City

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Abstract

Background: The study of genetic and genomic becomes provoital for understanding of human health and diseases. Community health nurses must possess necessary competencies to provide vital information, support, guidance, and education on genetic conditions. **Aim of the study:** To identify competencies, attitude and Knowledge of nurses about genetics and genomics. **Subjects and Method: Study design**: An analytical cross-sectional study design was utilized. **Settings of the study:** This study was conducted at maternal and child health centers (MCHs) at Tanta city. **Subjects:** All nurses working at these MCH and medical centers in Tanta city was included in the study about (144 nurses). **Tool:** Structured questionnaire sheet was used in this study consisting of four parts. **Part I:** Socio-demographic characteristic of nurses. **Part II:** Nurses' competencies regarding genetics and genomics. **Part III:** Attitudes of community health nurse. **Part IV:** Nurses' knowledge about genetics and genomics toward genetic testing, delivery of genetic services and toward their role in genetics. **Results:** It was illustrated that the majority (93.1%) of the studied nurses had positive attitude toward genetics and genomics. Meanwhile, almost all of them (100%) reported unsatisfactory competencies. Additionally, more than one third (41.7%) of them showed low knowledge level on genetics and genomics. **Conclusion:** All studied nurses had unsatisfactory competence, more than two fifth of them had low level of knowledge and the majority of them had positive attitude toward genetics and genomics topic. **Recommendations**: Providing ongoing education to enhance genetic and genomic competence among nurses of all degrees and practice areas.

Keywords*:* Attitude, competence, genetics and genomics, knowledge.

Introduction

The science of genetics and genomics provided a new perspective on the spectrum of human health and disease. Currently, diseases are diagnosed and infection pathways are identified using genetic information. People employ technology and genetic data, nevertheless, sometimes without realizing that genetic data also contains information on human hazards (i.e., immutability, heredity, and predictability).

The pursuit of human genome research has improved our comprehension of the significance of genetic and genomic education for medical professionals **(Kawasaki, Kawasaki, Iki, & Matsuyama, 2021)**.

Both genomics and genetics contribute to health and illness. The study of genes and how particular characteristics, such cystic fibrosis and Huntington's disease, are handed down from one generation to the next is known as genetics. The study of an individual's entire genome, or all of their genes, including how those genes interact with one another and with their surroundings, is known as genomics. This phrase is very new. Since complex diseases like cancer, diabetes, asthma, and heart disease are often caused by a combination of genetic and environmental variables rather than single genes, genomics is the scientific study of these conditions **(Buchman et al., 2020; National Human Genome Research Institute, 2018)**.

A genetic condition is caused by anomalies in one or more genes or chromosomes. These abnormalities can involve alterations to one gene, the accession or omission of the whole chromosome, or modification to several chromosomes. Multifactorial genetic disorders may occur as a result of environmental factors or complex gene interactions. The prevalence of genetic illnesses is higher among the Arab population.by the way, genetic disorders continue to contribute significantly to morbidity, mortality, and disability in Egypt **(Mohamed, Mohamed, Ghonaem, & Hafez, 2023)**.

Egypt has a large population, which presents serious economic and healthcare issues. With regard to this, genomic and genetic testing becomes a major challenge. Egypt emphasized how crucial it is to advance medical genetics and genomics across the country in order to effectively handle common genetic disorders. As a way to do this, it is important to gain a thorough understanding of the Egyptian genome, related disorders, and public attitudes toward the use of genetic services **(Hafez et al., 2024)**.

Genetics has emerged as a significant science for every aspect of nursing practice in the twenty-first century. Other developing-country studies show that nurses have a low level of genetics understanding and have had little exposure to genetics courses during their training. Genetics and genomics are integral to health care across all disciplines, specialties, and locations. Furthermore, it has implications in different fields of the healthcare continuum, such as prevention, assessment, screening, diagnosis, prognosis, treatment, evaluation of treatment effectiveness, as well as drug choices **(Wright, Zhao, Birks, & Mills, 2018)**.

Genomic technology advancements have changed healthcare focus away from simply diagnosing and treating genetic illnesses toward genetic risk assessment, counseling, and preventive strategies. The need for genetic services has expanded as diagnostic and treatment capabilities have improved. These services are available through a variety of pathways, including programs of newborn screening, whereby infants are tested for different genetic abnormalities right after delivery. Furthermore, approaches of clinical diagnostic integrate the experiences of geneticists, neurologists, oncologists, and other specialists **(Sharoff, 2015)**.

Competencies are measurable talents required to perform a task effectively. In general, to be granted certifications of course credit, or other recognition forms, competencies must be confirmed. Recently, nursing education is increasingly focusing on demonstrating competencies rather than just grades. These competencies should be evaluated on a regular

basis in most clinical practice settings **(Wang, Diao, & Salvador, 2023)**.

Essential genomic nursing competencies outline what knowledge, skills and attitudes a nurse needs to apply. Essential competencies are split into two categories: Professional Responsibilities Domain seeks to incorporate knowledge and skills of genetic and genomic into nursing practice as well as the professional practice domain. Competencies in the Professional Practice Domain involve Nursing Assessment of genetic and genomic factors, applying/integrating genetic Knowledge in care procedures; identifying patients who may benefit from genetic services, genetic referral activities, and provision of education, care, and support, with genetic and genomic-related content **(American Nurses Association, 2009).**

Human genetics has various applications in medicine. It can help to gather more genomic data for next generations **(Tonkin et al., 2020)**. Nurse leaders should develop strategies to provide nurses with the basic competencies. They are first line members of the health care team. They constitute the largest group of health care professionals working in different health care settings making them well positioned to deliver genomic healthcare. They also have the ability to drive cultural change for applying genomics in healthcare, and provide education to patients and providers of genomic interventions **(Global Genomics Nursing Alliance, 2022)**.

To integrate genetics and genomics into practice, health care providers need to have essential knowledge and skills regardless of profession and practice area. Nurses play a challenging role in providing health care services. They have to be proficient in applying genetics and genomics to health care settings. By the way, community health nurses (CHNs) working in primary or occupational healthcare settings play a crucial role in providing genetics knowledge for public because they usually contribute to health maintenance activities via face-to-face consultations **(Zureigat, Gould, & Seven, 2022)**.

Community health nurses are responsible for providing health care services related to genetics and genomics. These services include assessing disease risks, making medical referrals based on genetic risks, as well as advocating for communities and individuals especially who may benefit from genomics. In addition, they are in charge of providing general genetic education, genetic counseling, taking family history and genetic changes understanding, as well as targeted therapies. Moreover, they have the responsibility to be knowledgeable about informed consent, ethical, legal, and social issues as well as privacy and security concerns **(Allied Health Professionals Australia, 2023)**. Furthermore, CHNs play a critical role in monitoring adverse medication responses in homecare. **(Laaksonen, Airikkala, & Halkoaho, 2022)**.

Nurses are considered a significant segment of health workers as they are in focus involved in both individuals and families suffering from genetic diseases counseling. Also, genetic testing is now available for many disorders due to advancements in genomics, which have allowed for the identification of genetic variations. CHNs' knowledge and competencies regarding human genetics and genomics need to be evaluated. Enhancing knowledge regarding genetics seeks to improve the health of identified populations.

CHNs hardly take genetics into account in their daily care. In worth, knowledge of human genetics is poor among many CHNs **(Adejumo et al., 2021)**. Thus, the current study aims to identify competencies, attitudes and knowledge of nurses about genetics and genomics.

Aim of the study:

To identify competencies, attitudes and knowledge of nurses about genetics and genomics.

Subjects and method

Study design:

Analytic cross-sectional was used as a design for this study.

The study setting:

This study was implemented in all maternal and child health centers (MCH) and medical centers at Tanta city. Where Tanta city contained (4 MCH centers and 2 medical centers) related to the Ministry of Health and Population, offering maternal and child health services at Tanta city El-Gharbia governorate.

Subjects:

All nurses working at these MCH and medical centers in Tanta city were included in the study about (144 nurse).

Setting	Names	Numbers of nurses
MCH centers	Tanta Awal at Al-Shrouk	13
	Tanta Tanie at El-Embaby	14
	Tanta Rabaa at Kohafaa	16
	Tanta Khamis at Agizy	27
Medical centers	Medical center of Mohame Mashally at said street	39
	Segar medical center	35
Total	4 MCH and 2 medical centers	144 Nurses

Study tools:

Structured questionnaire sheet was used in: it gathered four parts:

Part 1: Socio demographic characteristic of nurses.

It assembled data about age, residence site, educational level, presence of congenital and hereditary diseases in their family and who are affected and type of their family.

Part2: Nurses' perception to their competencies regarding genetics and genomics.

In this part, the researchers adapted essential genetic competencies for nurses, which it was an instrument that developed by American Nurse Association in 2009, and updated by (Howington, Riddlesperger & Cheek, 2011) to assess nurses perception of their competencies. The scale accumulated 27 items. The Likert type scale was utilized to decide the level of acceptance on the statements and entered 4 points. Three points were given to 'very competent', 2 for 'competent', 1 for 'slightly competent' and zero for not competent.

The scale consisted of five subscales as follow:

- **Professional responsibility competencies** (6 items)
- **Scope of practice competencies** (8 items)
- **Identification competencies** (4 items)
- **Referral activities competencies** (1 item)
- **Provision of education, care and support competencies** (8 items)

The overall competencies total score extended from 0 – 81.

-Competencies total score was classified as follows

-Satisfactory competencies ≥ 75% of the entire competence score.

-Unsatisfactory competencies < 75% of the entire competence score.

Part 3: Attitude of community health nurses toward genetic testing, delivery of genetic services and toward their role in genetics.

In this part the researcher adapted the attitude of community health nurses toward genetic testing, delivery of genetic services and toward their role in genetics from a tool developed by (Rosso et al., 2020). It consisted of 10 items.

Scoring system:

Three -point Likert-type scale was applied and gathered: (agree, uncertain, and disagree). Community health nurse who responded by " agree answer " taken 2 points, while those answered uncertain, one point was given and zero was a score for disagree. The high score indicated the positive attitude.

The community health nurses' attitudes total scores were as follow:

- Positive attitude was ≥ 60% from the total.
- Negative attitude was < 60% from total.

Part 4: Nurses' knowledge about genetics and genomics

It was developed by researchers based on literature review (Buchman et al., 2020; Mohamed et al., 2023; National Human Genome Research Institute, 2018). It was used to assess community health nurses knowledge about genetics and genomics. It was composed of 21 statements such as a gene was a disease; there was a connection between consanguinity and genetic disease and genetic information assisted in predicting liability of some disease. The subjects reacted to each statement as true or false. Correct answer was taken score (1) and (0) for incorrect answer. The whole score extended from 0 to 21 scores.

The scoring system for knowledge was as following

- Low level of knowledge < 60 % from the whole score.
- Moderate knowledge 60 - < 75% from the whole score.
- High knowledge ≥ 75 % from the whole score.

Method

1. **Approval of the study:**

Official consent letter was gotten from the Dean of faculty of Nursing; Tanta University to the executives of MCH and medical centers at Tanta city and their authorization was gotten which encouraged information collection.

2. **Ethical considerations:**

- Consent of the ethical committee of the Faculty of Nursing was gotten. Code of ethics (476-5-2024).
- Every nurse was educated about the reasons, benefits and nature of the study at the prime of the study and they might be pulled out at any time from the study.
- The study was safe and not caused any harm and/ or torment for the study subject.
- Privacy and protection was put into thought with respect to the information collected.
- Informed consent was gotten from the studied nurses.

3. **Study tool development**

-The study tools were created by researchers after checking on the related literary works (**Buchman et al., 2020; Howington, et al., 2011; Mohamed et al., 2023; National Human Genome Research Institute, 2018; Rosso et al., 2020).**

-Tools of the study were analyzed for its content and face validity by five persons expertise in community health nursing field.

4. A pilot study was carried out on 10 % of subjects to test the tool for its clarity and applicability and to decide the needed length

of time to gather the data from each nurse. The necessary modification was done.

5. Reliability of the study tool was done by using Cronbach alpha test. It's results were (0.564) for socio demographic, (0.865) for competencies, (0.776) for attitude and (0.708) for knowledge about genetics and genomics.

6. Actual study:

-The researchers collected study data through three months beginning at first of April and ended at last of June 2024.

-The researcher met with the nurses three days per week in their place of work either in MCH or Medical centers

-The questionnaire was filled by the nurses.

-5-7 were the number of nurses filled the sheet per day.

-30-45 minutes were taken by each nurse to fill study sheet.

7. Statistical analysis:

Organization, tabulation and analysis of data were done using statistical package for social studies (SPSS) version 23. For numerical data range, mean and standard deviation were summed out. For categorical variables, numbers and percent were calculated. Chi-square test (x^2) was utilized for comparing data. To identify correlation between variables, Pearson's correlation coefficient (r) was used. A significance was adopted at $P<0.05$ for interpretation of results of tests of significance (*). Also, highly significant was adopted at $P<0.01$ for interpretation of results of tests of significance (**).

Results

Table (I): displays the distribution of the studied nurses according to their socio-demographic characteristics. It was found that, in terms of age, the majority of nurses (57.6%) were between the ages of 25 and 35, while just 20.1% were older than 45. It was discovered that the majority of the investigated nurses (72.9%) lived in rural areas. Additionally, it was shown that the majority of the nurses under study (66%) lived in nuclear families. About half of the nurses in the study had completed high school, while only 2.8% had earned a master's degree in nursing. Seventy-eight percent of the sample did not have any family history of chronic or hereditary disorders.

Table (2): demonstrates the distribution of the studied nurses according to means, standard deviations and ranges of their competencies toward genetics and genomics. The results showed that the mean ± standard deviation of scope of practice competencies and provision of education, care and support competencies were (9.16 ± 3.553 & 9.722 ± 3.651) respectively. While identification and referral competencies their means were (4.660 ± 1.809 & 0.99 ± 0.648) respectively.

Table (3): shows the distribution of the studied nurses according to their levels of competencies toward genetics and genomics. It was discovered that the mean ± SD was (31.590 ± 10.624) and ranged from (10-58) and all (100%) of the studied nurses had unsatisfactory practice.

Table (4): illustrates distribution of the studied nurses according to their attitude toward genetic testing, delivery of genetic services and toward their role in genetics. It was observed that 77.1% of the studied nurses concurred that funding should be allocated more toward the social and environmental causes of illness than toward the use of genetic testing. Tests should only be used in clinical and public health settings if economic analyses demonstrate that they have cost-effectiveness

ratios that are advantageous when compared to alternative health interventions. Of the nurses surveyed, 85.4% agreed with this statement, while just 1.4% disagreed. Genetic tests for lethal diseases (such BRCA testing for breast and ovarian cancer) ought to be given away for free at the time of delivery to those who could benefit from them and it should be taken into account in public health thinking that risk variables can have varying effects on different population subsets depending on genetic susceptibility, as evidenced by the fact that 84% and 77.8%, respectively, of them agreed, while only 1.4% disagreed. The majority of the nurses in the study (87.5%) believed that more genetic data would be used in public health initiatives (such as cancer screening and chronic disease prevention programs) in the future.

Table (5): Shows the distribution of the studied nurses according to their levels of attitude toward genetic testing, delivery of genetic services and toward their role in genetics. It was discovered that 93.1% of them had a favorable attitude toward genetics and genomics, while only 6.9% had a negative one with a mean of 17.94 ± 2.923.

Table (6): displays the distribution of the studied nurses according to their levels of knowledge toward genetics and genomics. The study revealed that two fifth (41.7%) of the studied nurses have low knowledge, while 39.6% had moderate knowledge and only 18.8% had high knowledge with a mean and SD of 63 ± 3.225.

Table (7): shows the relationship between the researched nurses' attitudes toward genetic testing, the provision of genetic services, and their role in genetics and the Sociodemographic traits of the nurses. The results demonstrated that there was no statistically significant relationship between the attitude of the nurse and either family type or age. Nonetheless, a statistically significant relationship was found between the attitude, the nurses' place of residence, and their educational attainment.

Table (8): illustrates the relationship between the investigated nurses' degrees of genetic and genomics knowledge and their socio-demographic traits. Age was found to have a statistically significant relationship with nurses' knowledge level since 62.5% of nurses were between the ages of 36 and 45 and had intermediate knowledge. However, no statistically significant relationship was found between knowledge and the other Sociodemographic traits of the nurses under study.

Table (9): demonstrates the correlation between socio demographic characteristics of the studied nurses, total competency score, total attitude score and total knowledge score. Age and educational levels were found to be positively and statistically significantly correlated with the overall competency score. Also there was a statistically significant positive correlation between total attitude score and family type. Meanwhile, there was a statistically significant negative correlation with the place of living. Furthermore, the total knowledge score was positively correlated with the educational level of the nurses.

Table (I): Distribution of the studied nurses according to their socio-demographic characteristics

Socio-demographic characteristics	The studied nurses (n=144)	
	No	%
Age in years		
25-35	83	57.6
36-45	32	22.2
More than 45	29	20.1
Range	25-57	
Mean ± SD	37.42± 9.657	
Sex		
Female	144	100.0
Place of residence		
Rural	105	72.9
Urban	39	27.1
Type of family		
Nuclear family	95	66.0
Single parent family	14	9.7
Extended family	35	24.3
level of education		
High school of nursing	64	44.4
Technical institute of nursing	52	36.1
Baccluric degree of nursing	24	16.7
Master degree in nursing	4	2.8
genetic or chronic diseases within the family		
Yes	42	29.2
No	102	70.8
affected family members	(n=42)	
Father or mother	21	50.0
Grandfather or grand mother	21	50.0

Table (2): Distribution of the studied nurses according to mean, standard deviation and range of their reported competencies toward genetics and genomics

Nurses reported competencies	The studied nurses (n=144)	
	Mean ± SD	Range
Professional responsibility competencies	7.062 ± 3.122	0 - 13
Scope of practice (Applying integrated genetic and genomic information) competencies	9.16 ± 3.553	0 – 18
Identification competencies	4.660 ± 1.809	1 – 10
Referral activities competencies	0.99 ± 0.648	0 – 3
Provision of education, care and support competencies	9.722 ± 3.651	3 - 17
Total competencies score	31.590 ± 10.624	10 - 58

Table (3): Distribution of the studied nurses according to their levels of their reported competencies toward genetics and genomics

Levels of competencies	The studied nurses (n=144)	
	No	%
Un satisfactory competence	144	100.0
Mean ± SD	31.590 ± 10.624	
Range	10-58	

Table (4): Distribution of the studied community health nurses according to their attitude toward genetic testing, delivery of genetic services and toward their role in genetics

Nurses attitude	The studied nurses (n=144)					
	Agree		Neutral		Disagree	
	No	%	No	%	No	%
Rather than implementing genetic testing, efforts should be directed toward the social and environmental causes of illness.	111	77.1	33	22.9	0	0.0
It is recommended that susceptibility (or predisposition) tests be incorporated into clinical and public health practices even in the absence of evidence-based health interventions.	104	72.2	38	26.4	2	1.4
Tests for susceptibility (or propensity) should only be used in clinical and public health settings if cost-effectiveness ratios indicate that they are superior to alternative medical interventions.	123	85.4	19	13.2	2	1.4
People who potentially benefit from genetic testing for diseases that could be deadly (e.g., BRCA testing for breast and ovarian cancer) should be given the tests for free at the point of delivery.	121	84.0	21	14.6	2	1.4
Given that genetic susceptibility might cause risk factors to affect subsets of the population differently, public health thinking should take this into account.	112	77.8	30	20.8	2	1.4
Public health experts ought to be included in the ongoing evaluation of the applicability and reliability of developing genomic applications.	108	75.0	28	19.4	8	5.6
Public health programs should actively implement genomic applications that are evidence-based (e.g. BRCA testing for relatives of known mutation carriers)	124	86.1	20	13.9	0	0.0
Public health professionals should measure the utilization of genetic services in order to assess unmet needs and inequalities of access to services	116	80.6	26	18.1	2	1.4
Practice results, process indicators, and the value offered by genomic applications should all be measured by public health experts.	119	82.6	23	16.0	2	1.4
I believe that genetic data will be used more in public health initiatives in the future (such as cancer screening and chronic disease prevention programs).	126	87.5	18	12.5	0	0.0

Table (5): Distribution of the studied community health nurses according to their levels of attitude toward genetic testing, delivery of genetic services and toward their role in genetics

Levels of attitude	The studied nurses (n=144)	
	No	%
Negative attitude	10	6.9
Positive attitude	134	93.1
Mean ± SD	17.94 ± 2.923	
Range	10-20	

Table (6): Distribution of the studied nurses according to their levels of knowledge toward genetics and genomics

Levels of knowledge	The studied nurses (n=144)	
	No	%
Low level of knowledge	60	41.7
Moderate level of knowledge	57	39.6
High level of knowledge	27	18.8
Mean ± SD	12.63 ± 3.225	
Range	3 - 18	

Table (7): Relation between socio- demographic characteristics and levels of the studied nurses' attitude toward genetic testing, delivery of genetic services and toward their role in genetics

Socio-demographic characteristics	The studied nurses (n=144)				X^2 p
	Negative attitude (n=10)		Positive attitude (n=134)		
	No	%	No	%	
Age in years					
25-35	4	4.8	79	95.2	2.109 0.348
36-45	4	12.5	28	87.5	
More than 45	2	6.9	134	93.1	
Place of residence					
Rural	4	3.8	101	96.2	5.896 0.025*
Urban	6	15.4	33	84.6	
Type of family					
Nuclear family	8	8.4	87	91.6	4.100 0.129
Single parent family	2	14.3	12	85.7	
Extended family	0	0.0	35	100.0	
level of education					
High school of nursing	6	9.4	58	90.6	
Technical institute of nursing	0	0.0	52	100.0	8.275 0.041*
Baccluric degree of nursing	4	16.7	20	83.3	
Master degree in nursing	0	0.0	4	100.0	
Are there is genetic or chronic diseases within the family?					2.258 0.128
Yes	5	11.9	37	88.1	
No	5	4.9	97	95.1	
If yes, who are the affected members?					2.626 0.269
Father or mother	3	14.3	18	81.7	
Grandfather or grand mother	2	9.5	19	90.5	

p<0.05* significant p<0.01** highly significant

Table (8): Relation between socio- demographic characteristics and levels of the studied nurses' knowledge toward genetics and genomics

Socio-demographic characteristics	The studied nurses (n=144)						X^2 p
	Low level of knowledge (n= 60)		Moderate level of knowledge (n=57)		High level of knowledge (n=27)		
	No	%	No	%	No	%	
Age in years							
25-35	35	42.2	32	38.6	16	19.3	14.480
36-45	10	31.3	20	62.5	2	6.3	0.006**
More than 45	15	51.7	5	17.2	9	31.0	
Place of residence							
Rural	47	44.8	37	35.2	21	20.0	3.064 0.216
Urban	13	33.3	20	51.3	6	15.4	
Type of family							
Nuclear family	35	36.8	42	44.2	18	18.9	4.306
Single parent family	6	42.9	6	42.9	2	14.3	0.366
Extended family	19	54.3	9	25.7	7	20.0	
level of education							
High school of nursing	27	42.2	24	37.5	13	20.3	11.586 0.072
Technical institute of nursing	25	48.1	21	40.4	6	11.5	
Baccluric degree of nursing	8	33.3	8	33.3	8	33.3	
Master degree in nursing	0	0.0	4	100.0	0	0.0	
Are there is genetic or chronic diseases within the family?							1.843
Yes	21	50.0	15	35.7	6	14.3	0.398
No	39	38.2	42	41.2	21	20.6	
If yes, who are the affected members?							6.727
Father or mother	13	61.9	4	19.0	4	19.0	0.151
Grandfather or grand mother	8	38.1	11	52.4	2	9.5	

p<0.05* significant p<0.01** highly significant

Table (9): Correlation between socio demographic characteristics of the studied nurses, total competency score, total attitude score and total knowledge score

Socio-demographic characteristics	Total competency score	Total attitude score	Total knowledge score
	R P	R P	r p
Age	0.437 0.000**	0.083 0.321	-0.082- 0.329
Place of residence	0.066 0.429	-0.289- 0.000**	0.114 0.175
Type of family	-0.023- 0.787	0.248 0.003**	0.007 0.930
Level of education	0.356 0.000**	-0.081- 0.336	0.174 0.037*
Total knowledge score	0.129 0.123	0.026 0.757	--

*. Correlation is significant at the 0.05 level (2-tailed).

**.Correlation is significant at the 0.01 level (2-tailed).

Discussion

The implications of genomics/genetics in nursing are becoming increasingly apparent in both nursing care and medication delivery. Many illnesses now have known genetic origins. Essential genomic nursing competencies include defining the information, abilities, and attitudes necessary for a nurse to conduct nursing evaluations on clients and identifying possible clients who might benefit from genomics **(Howington**, **Riddlesperger, & Cheek, 2011)**.

The nurses should possess the necessary knowledge and competencies to care for patients who visit genetic services, either to diagnose a genetic condition, or because they are aware of a condition in their family and need to understand their own options for managing the condition's consequences **(Hickey et al., 2018)**. Therefore, the study's aim was to evaluate competencies, attitudes and knowledge of nurses about genetics and genomics.

In order to deliver reliable genetic testing, counseling, and treatment, healthcare practitioners must possess a strong understanding of genes and genomics. This entails comprehending genetic ideas, evaluating the findings of genetic testing, and successfully conveying genetic knowledge. Professionals and people may acquire and comprehend more complicated material, thereby increasing their knowledge, and competences in genetics are most important **(Zureigat et al., 2022)**.

Although competence is essential for community health nurses, it was observed that all studied nurses reported unsatisfactory competence with a mean ± SD of 31.590 ± 10.624 (**Table 3).** This appears in all items of competence in professional responsibility, scope of practice, identification competencies, and referral activities (**Table 2).** From the researchers' point of view, this result is due to a lack of knowledge about this topic, as shown in Table 6. This may be due to little interest of health authority to this field.

These findings were consistent with those of **(Talwar, Tseng, Foster, Xu, and Chen (2017)**, who conducted systematic literature review on the effect of genetic education on the skills of health care practitioners. They observed that practically all studies had low levels of knowledge, attitudes, and competencies in genetics and genomics. In the same direction **(Houwink et al., (2015)**, stated that a before educational program about genetics and genomics among nurses, the majority of nurses who participated in the previous educational program regarding genetics and genomics had low competency levels**.**

Attitudes regarding genes and genomics impact how people perceive, interpret, and act on genetic information. Positive attitudes can motivate people to use genetic services and participate in research. A positive attitude toward genetics can promote acceptance of human genetic variety and the reality that everyone has a unique genetic makeup **(Wang et al., 2023)**.

Regarding participants' attitudes toward genetic testing, the delivery of genetic services, and their role in genetics, our results unexpectedly revealed that the majority of them had a positive attitude toward genetics and genomics (Table 4). These findings showed the nurses' interest in genetic testing as well as learning about genetics and genomics, which is beneficial to the success of any educational or health programs. This result is in line with **(Youssef, (2021)**, who stated that the majority of their participants had a positive attitude towards genetic testing and counseling. In addition, **(Wang et al., (2023)**, indicated that most of nurses considered learning about the genetics of common illnesses to be critical. Also, most of nurses agree that incorporating genetics into nursing practice improves treatment decisions, patient care, and adherence to clinical recommendations.

However, the study conducted by **(Mohamed, et al., (2023)**, did not confirm the present study results; they indicated that the majority of their samples had negative attitudes toward genetic and genomics education. Moreover, it is in contrast with a study carried out by **(Abd Elfattah, Soliman, and Amin (2015)**, which revealed that most students had negative attitudes regarding premarital genetic

counseling. The negative attitude of students may be attributed to fear of the unknown and the absence of screening culture in Egypt.

The minority of nurses in this survey showed an unfavorable attitude toward genetics and genomics. Unfavorable attitudes toward genetic testing and genetic counseling are frequently correlation with personal, social, and cultural obstacles such as misuse of genetic information (genetic discrimination), fear of stigmatization, conflict with personal beliefs, negative emotional responses to test results, and the genetic testing costs. Similarly, **(Riesgraf, Veach, MacFarlane, and LeRoy (2015**) stated that a low percentage of respondents would not trust genetic counselors or had conflicts with their own values in relation to the use of genetic services. From the researchers' point of view, the current study's findings support the possibility that future health education programs about genes and genomics will have a positive impact on nurses' awareness and attitudes because a sizable portion of them already have positive attitudes and just require proper acknowledgement.

Over time, novel genetic and genomic applications are created and incorporated into therapeutic procedures. It demonstrates the necessity of providing ongoing and up-to-date genetic and genomic information, particularly to nurses, in order to maximize comprehension of genomic risks, facilitate well-informed decision-making, and improve people's capacity to see genetic services as relevant to their own lives **(El-Hosany & Khaton, 2021)**.

Regarding total levels of knowledge, half of the studied nurses' knowledge related to genetics and genomics were poor, and more than one third of them had moderate knowledge, only a minority of them knew about genetic and genomics information in the present study (Table 6). The shortage in knowledge was related to most statements of assessment related to basic information in genetics and genomics. It may be because; about half of the sample did not complete their university education, and more than half of them, whose age ranged from 25 to 35 years, do not have sufficient knowledge and experience about the topic as shown in table (1). Besides the genes, genomic science is still uncommon.

This finding is in agreement with (**Rodriguez, (2022)**, who said that most nurses had inadequate awareness of genetic disorders. Also, our study results are in the same line with (**Guillory, (2022)**, who stated that eighty-four percent of nurses gave inaccurate answers and suggested taking training programs to raise their genetic knowledge and proficiency. Additionally, this result is in accordance with that of (**El-Hosany and Khaton, (2021); Youssef, (2021)** that examined nursing students' knowledge and attitudes about genetic disorders and genetic counseling and discovered that only 8.5% of the participants had a high level of understanding.

Socio demographic characteristics of the studied sample are variables that effects on knowledge, attitude and competences of the sample toward research topic. It was noticed that positive attitude was recorded among sample with high level of education and rural residence. It may be due to nearly three quarters of the sample had rural residence. Also, it observed that improvement in knowledge and competency score were associated with age and level of education (Tables 6 to 8).

These results are in agreement with the study of **(Houwink et al., (2015); Hafez et al., (2024)**, who reported that there was high positive correlation between age, educational levels and residence of the studied nurses and their knowledge, attitude and competences levels. But in contrast with study that done by **(El-Hosany et al., (2021)** stated that high level of knowledge and positive attitude were among female, medical field students and urban residence.

Conclusion

The study concluded that all the studied nurses reported unsatisfactory competence, half of them had poor knowledge levels, and the majority of them had a positive attitude toward genetics and

genomics topics. Also, it was noticed that there was a statistically significant relation between attitude, place of residence and level of education. Also, there was a statistically significant relation between knowledge and age. Finally, there was positive statistically significant correlation between total competency score, age and level of education.

Recommendations

With regard to the current study findings, the following recommendations are suggested:

1. Providing ongoing education and training to enhance genetic and genomic competences among nurses of all degrees and practice areas.
2. Creating policy and regulatory frameworks to support genetic counseling in health care settings.
3. Further research should be done to assess barriers that face nurses' performance regarding genetics and genomics.

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