

## RESEARCH ARTICLE

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# Saudi Nursing Students' Knowledge and Perception of Testicular Cancer Assessment and Management: A Cross-Sectional Study

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### Abstract

**Introduction:** Testicular cancer (TC) incidence is increasing worldwide. This study aimed to investigate Saudi nursing students' knowledge and perception about TC. **Method:** This cross-sectional study was done using convenience sampling method. In this study, 280 nursing students from different nursing schools in six cities of Saudi Arabia were recruited. A structured self-report questionnaire was used to collect data. **Result:** About 49.2% of the participants received education about TC in their nursing schools. The findings showed lack of enough knowledge about TC among Saudi nursing students. Mostly, the participants reported that heredity factor and having family history of TC (48.9%) and age between 56 and 70 years (41.8%) were the most common risk factors of TC. According to the participants, physical examination was the most common diagnostic test usually used for early detection of TC (40.4%) and biopsy test was the most accurate test to confirm TC diagnosis (45.4%). Only one third of the participants (34.6%) knew that between 75% and 100% of TC cases can be cured in case of early detection. About half of the participants (51.8%) reported that surgical procedure was the most common treatment for TC. The nursing students who had high GPA ( $r=0.86$ ,  $p<0.001$ ), were unwilling to get more information on TC ( $r=0.24$ ,  $p=0.04$ ), had family history of TC ( $r=0.53$ ,  $p=0.02$ ), medical problems with testicles ( $r=0.69$ ,  $p=0.01$ ), received education about TC in their school of nursing ( $r=0.65$ ,  $p=0.02$ ), and were more self-confident in assessing and managing TC ( $r=0.38$ ,  $p=0.03$ ) had higher level knowledge about TC. **Conclusion:** Despite the importance of nurses' roles in assessing and managing TC, nursing students in Saudi Arabia still did not have enough knowledge about TC. Improving nursing programs' curricula and conducting health education programs are recommended.

**Keywords:** Testicular cancer- nursing students- nursing students' knowledge- Saudi Arabia

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### Introduction

Testicle as a male sexual organ is responsible for the production of testosterone as well as production and storage of semen. Testicular cancer (TC) is defined as an abnormal growth of cells in one or both testicles (Albers et al., 2015; Baird et al., 2018). Fortunately, TC is a rare malignant cancer accounting for about 1% of all males' cancers and has an excellent cure rate. In addition, the mortality rate of patients with TC is very low. In other words, The 5-year survival rate for TC patients is 95% (Albers et al., 2015; Farmanfarma et al., 2018; Gilligan et al., 2019). However, the recent statistics have shown that TC incidence is increasing worldwide (Farmanfarma et

al., 2018; Gilligan et al., 2019). TC mostly affects young adults aged between 15 and 34 years old (Albers et al., 2015; Farmanfarma et al., 2018).

Nevertheless, TC diagnosis can be distressing for the patient and his family. Literature documented that most cases of TC are discovered by testicular self-examination (TSE). According to previous studies, the chance of TC treatment is very high even in cases where it is detected at an advanced stages (Albers et al., 2015; Baird et al., 2018). Nevertheless, there is not enough knowledge about TC and TSE among men in Arab communities, including Saudi Arabia and Bahrain (Abd Algany et al., 2015; Alamri et al., 2021; Alaradi et al., 2020; Saab et al., 2016; Salati et al.) and even in developed countries

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(Albers et al., 2015; Farmanfarma et al., 2018; Gilligan et al., 2019; Ugboma et al., 2011). The importance of improving young males' knowledge and awareness about TC prevalence, TC symptoms, and how to perform TSE is documented in previous studies (Aksoy et al., 2022; Albers et al., 2015; Marks, 2017; Saab et al., 2016; Ugboma et al., 2011; Wanzer et al., 2014). Health professionals, particularly nurse educators, play major roles in providing health education and counseling people in public about TC and the importance of doing TSE as a method for detecting and preventing TC. Moreover, bedside nurses, who are directly assigned for taking care of patients with TC, have an important role in assessing, managing, and providing care to these patients (Akers, 2018; Albers et al., 2015; Saab et al., 2016). To fulfill these roles efficiently, nurses have to be knowledgeable and competent about assessment and management of TC. However, there is few studies investigating nursing staff and students' knowledge about TC and TSE in Middle East countries, specifically in Saudi Arabia (Ahmed et al., 2019; Akca et al., 2021; Alaradi et al., 2020). Nursing schools can play an efficient role in enhancing nurses' knowledge and awareness of TC and TSE. Moreover, nursing schools have major roles in preparing nursing students to carry out their nursing responsibility in providing health education about TC and TSE and to do health assessment and management as well as take care of patients with TC. To the best of our knowledge, no study has yet investigated nursing students' knowledge and awareness about TC in Saudi Arabia. Therefore, this study was conducted to assess knowledge and perceptions of nursing students from different Saudi regions about TC. The findings of this study may contribute health professionals and educators in developing guidelines for preventing TC and provide baseline information for further clinical research to discover the effect of health education programs on improving nurses' knowledge about TC in Saudi Arabia and other Arab countries.

### *Study objectives*

This study aimed to identify: 1) the source of nursing students' knowledge and their willingness to participate in educational programs about TC, 2) the nursing students' knowledge about TC, 3) the nursing students' perceptions about TC, and 4) factors affecting knowledge and perception about TC

## **Materials and Methods**

### *Design*

This correlational cross-sectional study was conducted to describe Saudi nursing students' knowledge and perceptions about TC.

### *Sample and Setting*

The convenience sampling method was used to select 280 male nursing students from 6 different cities in Saudi Arabia. Nursing students were recruited from Al-Rayan Colleges, Medina city, (N= 73 students) and six campuses of nursing colleges at Al-Ghad International Colleges for Applied Medical Sciences (N= 207 students), which

are located in Riyadh (N= 40 students), Medina (N= 37 students), Dammam (N= 31 students), Jeddah (N= 30 students), Qassim (N= 38 students), and Tabuk (N= 31 students) cities in Saudi Arabia. The inclusion criteria were being a full time male nursing student, successfully completed physical examination course and three courses of medical-surgical nursing, and being able to understand English language. Any nursing student who previously was diagnosed with TC was excluded from the study.

G \* Power was used to calculate the effective sample size. The researchers considered power of 0.80, moderate effective size of 0.30, and alpha value of 0.05 to conduct correlation analysis. The effective sample size was estimated as 268 students. The researchers distributed 300 questionnaires among the recruited participants. A total of 280 questionnaires were fully completed by the participants.

### *Data Collection Procedure and Ethical Considerations*

Before conducting this study, formal approval was obtained from the Institutional Review Board (IRB) at Al-Ghad International Colleges. To identify the potential eligible participants, the researchers obtained the names of eligible students and their class timetables from the heads of nursing departments. Then, the researchers met the eligible nursing students in the nursing colleges' classrooms at the selected settings. The researchers explained the objectives of the study to the eligible participants and invited them to participate in the study. All nursing students who accepted to participate in the study signed written consent form. The participants were informed that their participation is voluntary and their personal information would be confidential and anonymous. The researchers collected the data directly through structured self-report questionnaire. No physical measurement or educational interventions were provided. Completing the questionnaire took about 15 minutes.

### *Instruments*

The researchers used structured self-report questionnaire, which extracted data about respondents' 1) demographic and academic achievement information, 2) source of information about TC and willingness to improve knowledge about TC, 3) health status and possible risk factor to develop TC, and 4) knowledge and perception about TC.

Demographic information included respondents' marital status, accumulated Grade Point Average (GPA), and level of education in nursing program. To evaluate the participants' health, they were asked to report their history of chronic disease and rate their health status using 5-point Likert scale (1=poor, 2=fair, 3=good, 4=very good, and 5=excellent). In addition, they were asked about history of using tobacco and having medical problems with testicles and family history of TC. The participants were also asked about their source of information about TC, willingness to get more information on TC, and self-confidence in their knowledge of assessing and managing TC. The participants' response about self-confidence in their knowledge ranged between 0 (no self-confidence) and 10 (highest self-confidence).

To determine participants' knowledge level about TC, the researchers used ten multiple choice questions adopted from previous studies (Ahmed et al., 2019; Alamri et al., 2021; Avci et al., 2018; Baird et al., 2018). Specifically, these questions are developed to examine the knowledge about the prevalence, risk factors, common diagnostic test of TC, and TC treatment. Furthermore, four-point Likert scale, with these responses (1=strongly disagree, 2=disagree to some extent, 3=agree to some extent, and 4=strongly agree), was used to identify the participants' perception about TC. Higher scores indicate higher perception of TC.

#### Data Analysis

SPSS (version 25) was used for statistical analysis. Descriptive statistics and frequencies were used to analysis participants' demographic information, self-rated health status, as well as knowledge and perception about TC. Correlation analyses were used to identify the bivariate associations between participants' knowledge about TC and participants' perception of TC variables and students' GPA, level of education in nursing program, health status, source of information about TC, and self-confidence in their knowledge of assessing and managing TC.

## Results

#### Participants' demographic information and health status

Table 1 shows that majority of the participants (86.4%) were single and in third year of nursing program (44%). The mean of cumulative GPA was  $3.42 \pm 0.39$  out of 5. Most of the participants rated their health status as excellent (76.1%) and reported that they had no chronic disease (90.7%). Approximately, one-third of the participants were current tobacco users. Only 6.4% of the participants had family history of TC and 2.9% experienced medical problem with testicles.

#### Source of participants' knowledge of TC and their willingness to improve their knowledge about TC

Most of the participants were aware of TC (89.6%). Approximately, 64% of the participants learned about TC. About half of the participants (49.2%) did not receive information about assessment and management of TC during their study as nursing students. Two-thirds of the participants were willing to participate in educational programs about TC. Most of the participants (84.6%) preferred to take courses (as source of knowledge) to improve their knowledge about TC in the future. Based on our findings, mean participants' self-confidence in knowledge of assessing and managing TC was  $5.3 \pm 1.7$  out of 10 (Table 2).

#### Participants knowledge about TC

One third of the participants reported that the prevalence of TC was between 10% and 19.9% among all male cancers. Mostly, the participants reported that heredity factor and having family history of TC (48.9%) and age between 56 and 70 years (41.8%) were the most common risk factors of TC. According to the participants, physical examination was the most common diagnostic

test usually used for early detection of TC (40.4%) and biopsy test was the most accurate test to confirm TC diagnosis (45.4%). Most of the participants believed that pain or discomfort in the testicle or scrotum (32.9%) was the earliest symptom of TC. Only one third of the participants (34.6%) knew that between 75% and 100% of TC cases can be cured in case of early detection. About half of the participants (51.8%) reported that surgical procedure was the most common treatment for TC (Table 3).

#### Participants' perception about TC

Mostly, the participants agreed or strongly agreed that family history of TC (80%) and being black and from Asian countries (61.8%) were risk factors to get TC. The participants believed that a man might have TC without symptoms (62.5%), TC can develop in one or both testicles (86.1%), TC causes infertility (70.7%), and TC can be prevented (75.7%). On the other hand, most of the participants disagreed or strongly disagree that self-examination for TC is needed only when the person has symptoms (69.3%), testicular tumors are metastatic (70.7%), TC can lead to serious illness or death (75.4%), there is no cure for TC (78.2%), and doing TSE is enough to detect TC (62.9%) (Table 4).

Table 1. Participants' Characteristics and Health Information

Variable	n (%)
Marital status	
Single	242 (86.4)
Has been married	38 (13.6)
Setting of nursing school	
Al-Rayan Colleges	73 (26.1)
Al-Ghad International Colleges	207 (73.9)
Level of education in nursing program	
Third year	123 (43.9)
Fourth year	98 (35)
Internship	59 (21.1)
In general, how would you rate your health status	
Excellent	213 (76.1)
Very good	31 (11.1)
Good	27 (9.6)
Fair	8 (2.9)
Poor	1 (0.4)
Have you been diagnosed with any chronic disease	
Yes	26 (9.3)
No	254 (90.7)
Risk factors	
Tobacco user (yes)	91 (32.5)
Family history of TC (yes)	18 (6.4)
History of medical problem with testicles	
Yes	8 (2.9)
Mean ( $\pm$ SD)	
GPA	3.42 ( $\pm 0.39$ )

Table 2. Source of Participants' Knowledge and Participants' Willingness to Participate in Educational Programs about TC

Variables	n (%)
Having heard of TC (yes)	251 (89.6)
Have been learned about TC (yes)	179 (63.9)
Does your knowledge about assessment and management of TC depend upon the information you have received from the school of nursing? (N=179)	
No, not at all	88 (49.2)
Yes, to some extent	33 (18.4)
Yes, to high extent	24 (13.4)
Yes, at all	34 (19.0)
Willing to participate in educational programs about TC	
Yes	189 (67.5)
No	91 (32.5)
Preferred source of knowledge to improve knowledge of TC assessment and management. *	
Professional education (collage of nursing)	237 (84.6)
Seminar or/and workshop	79 (28.2)
Conferences	21 (7.5)
Internet or media (e.g. TV, radio)	64 (22.9)
Friends and relative	35 (12.5)
Participants' self-confidence in their knowledge to assess and manage TC (Ranging between 0 and 10)	Mean ( $\pm$ SD) 5.3 ( $\pm$ 1.7)

\*, The participants may select one or more choices

### Correlated factors of participants' knowledge and perception about TC

The findings revealed significant associations between participants' knowledge about TC and GPA ( $r=0.86$ ,  $p<0.001$ ), level of education in nursing program ( $r=0.43$ ,  $p=0.03$ ), studying in Al-Rayan Colleges ( $r=0.43$ ,  $p=0.03$ ), not willing to get more information on TC ( $r=0.24$ ,  $p=0.04$ ), family history of TC ( $r=0.53$ ,  $p=0.02$ ), history of having medical problems with testicles ( $r=0.69$ ,  $p=0.01$ ), received information about TC from nursing school ( $r=0.65$ ,  $p=0.02$ ), self-confidence to assess and manage TC ( $r=0.38$ ,  $p=0.03$ ), and having correct perception about TC ( $r=0.91$ ,  $p<0.001$ ). Moreover, significant associations were found between participants' correct perception about TC and GPA ( $r=0.72$ ,  $p<0.001$ ), education in nursing program ( $r=0.51$ ,  $p=0.02$ ), studying at Al-Rayan Colleges ( $r=0.37$ ,  $p=0.04$ ), not willing to get more information on TC ( $r=0.31$ ,  $p=0.04$ ), family history of TC ( $r=0.56$ ,  $p=0.02$ ), history of having medical problems with testicles ( $r=0.64$ ,  $p=0.01$ ), received information about TC ( $r=0.62$ ,  $p=0.02$ ), and self-confidence to assess and manage TC ( $r=0.54$ ,  $p=0.02$ ) (Table 5).

## Discussion

This study was conducted to identify source of nursing students' knowledge about TC, and nursing students' willingness to participate in educational programs about TC, nursing students' knowledge and perceptions about TC, and factors affecting nursing students' knowledge

Table 3. Participants' Knowledge about TC

Variables	n (%)
1. How common is TC in men?	
1% - 4.9% of all male cancers	52 (18.6)
5% -9.9% of all male cancers	89 (31.8)
10%-19.9% of all male cancers	94 (33.6)
20%-25% of all male cancers	33 (11.8)
> 25% of all male cancers	12 (4.3)
2. What is the most common risk factor of TC?	
Old age	53 (18.9)
Never having children	15 (5.4)
Non-descending testicle (cryptochidism)	43 (15.4)
Heredity and family history of TC	137 (48.9)
Testicular atrophy	21 (7.5)
Twinsip or abnormal semen parameters	11 (3.9)
3. At which age are men at the greatest risk of TC?	
71 years or older	74 (26.4)
Between 56 and 70 years	117 (41.8)
Between 36 and 55 years	54 (19.3)
Between 15 and 35 years	21 (7.5)
< 15 years	14 (5)
4. Which of these diagnostic tests is the most common one for early detection of TC?	
Physical examination (including TSE)	113 (40.4)
Scrotal ultrasound	52 (18.6)
Computerized tomography (CT) scan	39 (13.9)
Magnetic resonance image (MRI)	25 (8.9)
Biopsy	10 (3.6)
Blood tests or tumor markers	11 (3.9)
5. Which of these diagnostic tests is the most accurate one to confirm a diagnosis of TC?	
Physical examination	9 (3.2)
Scrotal ultrasound	16 (5.7)
Computerized tomography (CT) scan	34 (12.1)
Magnetic resonance image (MRI)	63 (22.5)
Biopsy procedure	127 (45.4)
Blood tests or tumor markers	31 (11.1)
6. Which of these clinical manifestations is the most earliest sign or symptom of TC?	
Enlargement or hardening of the testicle	47 (16.8)
Pain or discomfort in a testicle or in the scrotum	92 (32.9)
A feeling of heaviness in the scrotum	78 (27.9)
A dull ache in the lower abdomen, back or in the groin	24 (8.6)
A sudden collection of fluid in the scrotum	25 (8.9)
Dysuria, burning sense on urination, or hematuria	14 (5.0)
7. Which of these clinical manifestations is the most common sign or symptom of TC?	
Enlargement or hardening of the testicle	83 (29.6)
Pain or discomfort in a testicle or in the scrotum	75 (26.3)
A feeling of heaviness in the scrotum	38 (13.6)
A dull ache in the lower abdomen, back or in the groin	36 (12.9)
A sudden collection of fluid in the scrotum	30 (10.7)
Dysuria, burning sense on urination, or hematuria	18 (6.4)

Table 3. Continued

Variables	n (%)
8. What percentage of TC cases can be cured in case of early detection ?	
0 – 9%	17 (6.1)
10-24%	53 (18.9)
25 – 49%	36 (12.9)
50 – 74%	77 (27.5)
75 – 100%	97 (34.6)
9. After treating TC, should the affected testis be removed ?	
Yes, always	65 (23.2)
Yes, sometimes	38 (13.6)
No, not at all	147 (52.5)
Do not know	30 (10.7)
10. What is the most common TC treatment method?	
Surgery	145 (51.8)
Chemotherapy	74 (26.4)
Radiotherapy	44 (15.7)
Others (e.g. biotherapy, herbal treatment, and dietary treatment)	17 (6.1)

Table 4. Participants' Perception about TC

Variables	n (%)
1. Men who have blood relatives with TC are more likely to get TC	
Strongly agree	82 (29.3)
Agree to some extent	142 (50.7)
Disagree to some extent	38 (13.6)
Strongly disagree	18 (6.4)
2. Black and Asian men are at higher risk of TC than white men *	
Strongly agree	82 (29.3)
Agree to some extent	91 (32.5)
Disagree to some extent	57 (20.4)
Strongly disagree	50 (17.9)
3. A man may have TC without symptoms	
Strongly agree	38 (13.6)
Agree to some extent	137(48.9)
Disagree to some extent	49 (17.5)
Strongly disagree	56 (20.0)
4. Self-examination for TC is needed only when the person has symptoms *	
Strongly agree	24 (8.6)
Agree to some extent	62 (22.1)
Disagree to some extent	114 (40.7)
Strongly disagree	80 (28.6)
5. TC can develop in one or both testicles	
Strongly agree	85 (30.4)
Agree to some extent	156 (55.7)
Disagree to some extent	27 (9.6)
Strongly disagree	12 (4.3)
6. Testicular tumors are commonly metastatic (have the ability to spread to other organs such as the lungs and brain) *	
Strongly agree	39 (13.9)
Agree to some extent	43 (15.7)
Disagree to some extent	94 (33.6)
Strongly disagree	104 (37.1)

Table 4. Continued

Variables	n (%)
7. TC is commonly responsible for serious diseases or death *	
Strongly agree	23 (8.2)
Agree to some extent	46 (16.4)
Disagree to some extent	75 (26.8)
Strongly disagree	136 (48.6)
8. If someone is diagnosed with TC, he may become infertile	
Strongly agree	83 (29.6)
Agree to some extent	115 (41.1)
Disagree to some extent	48 (17.1)
Strongly disagree	34 (12.1)
9. TC can be prevented	
Strongly agree	129 (46.1)
Agree to some extent	83 (29.6)
Disagree to some extent	37 (13.2)
Strongly disagree	31 (11.1)
10. There is no treatment for TC *	
Strongly agree	15 (5.4)
Agree to some extent	46 (16.4)
Disagree to some extent	125 (44.6)
Strongly disagree	94 (33.6)
11. Doing testicular self examination is enough to diagnose TC *	
Strongly agree	37 (13.2)
Agree to some extent	67 (23.9)
Disagree to some extent	85 (30.4)
Strongly disagree	91 (32.5)

\* The most correct answer on these items is "Strongly disagree." So, these items were reversed coding as (4=strongly disagree), (3=disagree to some extent), (2=agree to some extent), and (1=strongly agree).

and perception about TC. The majority of participants reported that they had heard and learned about TC were willing to improve their knowledge of TC, specifically before graduation. Only about half of the participants were not educated about TC in their nursing school. In addition, it was found that the participants had moderate self-confidence in their knowledge to assess and manage TC (mean=5.3 out of 10), which was in line with previous studies (Ahmed et al., 2019; Akca et al., 2021; Saab et al., 2016). Generally, the findings suggested the importance of improving knowledge of nursing students about assessment and management of TC. Moreover, considering the findings of this study and previous studies, it is recommended to use a wide range of educational resources (e.g. social media, courses, conferences, and workshops) and develop nursing programs' curricula on the assessment and management of TC and TSE in Saudi Arabia (Ahmed et al., 2019; Akca et al., 2021; Altunkurek, 2020; Marks, 2017; Saab et al., 2016). Literature review showed that TC commonly affects young men age between 15 and 35 years old. The prevalence of TC is 1% worldwide. However, recent statistics showed that TC incidence has increased globally. Heredity and family history of TC as well as cryptorchidism are the major risk factors of TC. The treatment rate of TC is very high (> 90%), particularly if it is detected or diagnosed in early

Table 5. Correlated Factors of Participants' Knowledge and Perception about TC

Variables	Students' knowledge about TC		Students' perception about TC	
	Correlation (r)	p value	Correlation (r)	p value
participants' GPA	0.86	< 0.001	0.72	< 0.001
Setting of nursing school (Taibah University)	0.43	0.03	0.37	0.04
Level of education in nursing program	0.43	0.03	0.51	0.02
Willingness to get more information on TC (No)	0.24	0.04	0.31	0.04
Rate of participants' health status	0.14	0.28	0.25	0.16
Tobacco use (Yes)	0.18	0.09	0.23	0.08
Family history of TC (yes)	0.53	0.02	0.56	0.02
Medical problems with testicles (Yes)	0.69	0.01	0.64	0.01
Participants' knowledge about TC depends upon the information that have received from the school of nursing	0.65	0.02	0.62	0.02
Participants' self-confidence in their knowledge to assess and manage TC	0.38	0.03	0.54	0.02
Participants' perception about TC	0.91	< 0.001		

stage. TSE is an important method for early detection of TC, and it is recommended to do TSE once a month during or after hot or warm shower (Baird et al., 2018; Cheng et al., 2018; Farmanfarma et al., 2018; Shanmugalingam et al., 2013). The findings of this study also showed that the participants had not enough knowledge about the characteristics, symptoms, risk factors, and management of TC. For example, about 81% of the participants overestimated the global prevalence of TC. Although non-descending testicle (cryptochidism) is considered as one of the common risk factor of TC (Cheng et al., 2018), only 15.4% of the participants noted it as a common risk factor of TC. Despite the fact that all the nursing students participated in this study are considered as high risk age group to get TC, only about 7.5% of them were not aware that they fell within this age group. Literature showed the importance of physical examination for early detection of TC and biopsy test for the confirmation of TC (Baird et al., 2018); however, only about half of the participants were aware of these diagnostic tests. Moreover, it was found that the participants did not have enough knowledge about the treatment rate and the most common treatment methods of TC, which was in line with findings reported in previous studies (Ahmed et al., 2019; Akca et al., 2021; El Mezayen et al., 2019).

Furthermore, the findings of this study showed incorrect perception and awareness about risk factors, detection, and management of TC. For example, only about two-thirds of the participants believed that if someone was diagnosed with TC, he may become infertile. Despite the fact that white men are 4 to 5 times more likely to have TC (Akers, 2018; Shanmugalingam et al., 2013), only about one third of the participants were strongly disagree or disagree that black and Asian men are exposed to higher risk of TC than white men. Moreover, more than three-quarters of the participants incorrectly perceived that TC cannot be preventable and it is not curable. These findings were consistent with the findings reported in several previous studies conducted on nurses and nursing students in different countries (Ahmed et al., 2019; Akca et al., 2021; El Mezayen et al., 2019; Saab et al., 2016).

Although our participants were passed most of basic courses in nursing program, including physical examination and medical-surgical courses, the findings showed that only half of them learnt about TC, suggesting that not all nursing schools in Al-Ghad International Colleges include medical disorders related to male reproductive system malignancies (e.g. TC) in their nursing program's curricula. According to the findings of this study, to reduce lack of knowledge about TC, it is recommended to cover medical disorders related to male reproductive system malignancies in all nursing programs' curricula or at least teach this topic to male nursing students.

#### *Study strengths and limitations*

To the best of our knowledge, there is no study conducted on Saudi nursing students to assess their knowledge and perception about TC. The study findings can provide baseline information about nursing students' knowledge about TC, and consequently can help nursing schools to develop more comprehensive nursing programs' curricula. Despite these strengths, there were some limitations. Using cross-sectional design limited the identification of causality relationships among the studied variables. Using convenience sampling methods also limited generalization of the study findings to other nursing students in Saudi regions.

In conclusion, despite the importance of nurses' roles in educating the public about TC, which is important in early detection and prevention of TC, and in assessing, managing, and taking care of patients with TC, the finding of this study and previous literature showed lack of enough knowledge about TC among nursing students. Therefore, all nursing schools in Saudi Arabia are recommended to develop comprehensive nursing programs focusing on characteristics, symptoms, detection, assessment, and management of TC. Furthermore, to improve nursing students' confidence and skills to efficiently fulfill nursing roles regarding health education, it is recommended to motivate nursing students to participate in small group discussion (e.g. in nursing oncology course), design and

develop health educational materials about TC and TSE such as audio-video media and written materials (e.g. brochures), and conduct health education classes about TC and TSE for public.

### Author Contribution Statement

All authors conceived and designed the study, conducted research, provided research materials. RAE and ZTS analyzed and interpreted data. All authors wrote initial and final draft of article, and provided logistic support. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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#### Availability of data

Data are available upon official request from the corresponding author

#### Ethical approval

Permission was obtained from the ethical research committee of Al-Ghad International Colleges (approval number: AGICAMS-19/328)

#### Conflict of interest

There is no conflict of interest to be declared.

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