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Undergraduate Nursing Student Perceptions and Knowledge of Chest Tube Drainage
Systems

An Honors Thesis submitted in partial fulfillment of the requirements for Honors in
Waters College of Health Professionals

By

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Abstract

For the purpose of this study, a chest tube drainage system (CTDS) is defined as a tube placed in the thoracic cavity using a Trocar that connects to an outside drainage system to remove air and fluid. A convenience sample of prelicensure baccalaureate nursing students at one four-year multiple campus Carnegie Research University were surveyed using a voluntary 10-question multiple style questionnaire. This research was designed to evaluate common perceptions and levels of understanding regarding CTDS, among current prelicensure baccalaureate nursing students at a four-year university. The questionnaire explored basic knowledge and level of comfort and understanding of CTDS. The data was collected using a proprietary online research survey service. The results show that students were able to grasp basic concepts of CTDS; however, the data suggests that students do not feel confident or comfortable working with CTDS in the practice setting. It is disconcerting that students do not feel confident or comfortable taking care of patients with CTDS in the clinical setting, due to the ever-growing prevalence of the systems in the present healthcare environment. Although these conclusions may be drawn from the data collected, the results may not be representative of the population secondary to the low response rate. The fact that this research was conducted during the COVID-19 pandemic may help explain the low response rate.

This study explores student's perceptions and understanding of chest tube drainage systems (CTDS). For the purpose of this research, a CTDS is defined as a closed system that begins with a tube placed in the thoracic cavity continuing outside the chest and connected to a drainage system for the purpose of removing air and fluid. The CTDS has an interesting history that includes a series of technological advances which is expounded upon further in the literature review. The idea for this research began with the author experiencing internal feelings of discomfort regarding CTDS and was designed with the hopes that understanding student perceptions regarding CTDS will help faculty enhance didactic and clinical learning opportunities for nursing students. This is vital due to the higher acuity of patients and increasing prevalence of chest tube systems in non-intensive healthcare settings such as the medical-surgical units. Despite the increasing patient acuity indicating a potential growing prevalence of CTDS in non-intensive settings, the students who, like the researcher, may have felt uncomfortable prior to this growth may now have a growing uneasiness regarding CTDS. Therefore, the researcher hypothesizes that there will be a lack of basic knowledge and comfortability regarding CTDS. The overall purpose of this research was to analyze common perceptions and levels of understanding of students regarding CTDS among current four-year prelicensure bachelorette nursing students.

Literature Review

A review of the literature revealed an extensive history of chest tube drainage systems (CTDS) and how technology has influenced the evolution of the CTDS over time. Walcott-Sapp and Sukumar spoke of the first chest tube drainage system stating that, "the first description of a water-seal chest drainage system may be attributed to

Playfair in 1873, in the treatment of a child with thoracic empyema. He initially performed four aspirations, but each time the pleural fluid re-accumulated ... The tube drained one to two ounces of pus daily without any entry of air into the pleura, and the patient's clinical condition improved" (p. 6, 2015). Walcott-Sapp and Sukumar recounted the purpose of the first CTDS was a result of the clinical practice failing to improve the patient's condition. This original CTDS only was simple in its physical structure; however, despite its simplicity it was instrumental in improving patient outcomes. From the time of its introduction into the healthcare setting in the 19th century, chest tube drainage systems have evolved to become more complex. The first major evolution of the system occurred in the 20th century with the introduction of the integration of a disposable three-bottle system. It was reported that, "In 1967, Deknatel introduced the first integrated disposable chest drainage unit based on the three-bottle system. The main rationale of this approach was at this time that suction was always required to pull air and fluid out of the pleural space and pull the lung up against the parietal pleura. If suction is required, a third bottle is added" (Zisis, et al., p 3, 2015). This three-bottle system is the basis for both the wet and dry chest tube drainage system types we have today. According to Nadine Salmon and Shelly Lynch, a chest tube drainage system is defined as, "... a device used to collect chest drainage (air, blood, effusions), and connects to the end of the chest tube. Most commonly, drainage devices use a single unit that has three chambers, based on the old three-bottle system. The three chambers each provide separate functions of: Fluid collection, Water seal (which serves as a simple one-way valve), and Suction control" (p. 11, 2013). The reader should make the notable connection of this definition comparable to the three-bottle system which was introduced in the 20th century. Today

there are various types and sizes of CTDS are dependent upon the patient's condition, level of mobility, and healthcare provider preference. It is reported that, "chest tubes are approximately 20 inches (51 cm) long and vary in size from 12F to 40F" (Lewis, Bucher, Heitkemper, and Harding, p 522, 2017). This demonstrates that CTDS have had extensive development in their structure, purpose, and specificity to the patient from when they were first developed in 1873.

The existing research has resulted in the discovery of new technological advancements as well as different educational related studies regarding CTDS. In 2019, a journal reported on the existence of a digital chest tube drainage system and compared its effectiveness to the traditional CTDS. One of the major improvements of using the digital type of system, which uses a wireless internet connection, is the reduction of days the patients needs the system for recovery as well as a reduction of air leaks and other adverse events. (Jacobsen, Talbert, and Boyer, 2019). In Egypt, a recent study was performed in which a group of practicing nurse was educated more extensively educated about the care of patients with CTDS that resulted in improving overall patient outcomes (Bedier, El-Ata, and Ibrahim, 2016). However, no studies could be found that specifically mention the perceptions of any subjects regarding chest tube drainage systems, including students enrolled in a nursing program.

Methods

Ethics

Institutional Review Board (IRB) approval was obtained on December 10, 2019. An exemption 2 form was submitted for IRB approval which denoted all intended research

to be done, how data was to be collected, and the specific subjects in which the research would focus on for research purposes. The researcher also completed CITI training in order to meet requirements to conduct research ethically. This research was approved in order to obtain knowledge about student perceptions for the University to be able to see and analyze how current students within the nursing program feel regarding CTDS.

Design

An anonymous ten-question survey was developed by the researcher with the mentor's guidance and sent to current 4-year prelicensure baccalaureate nursing students. The objective was to assess perceptions and levels of understanding regarding chest tube drainage systems. Question formats in the created anonymous survey include multiple choice and true or false to assess basic knowledge and Likert scale questions to assess levels of understanding and comfortability of the students. The survey was created through Qualtrics®, a proprietary survey-style resource. Parametric and descriptive statistics were utilized to analyze the distribution and possible patterns of data results. During data collection, the data was saved on the password protected online survey resource. After the data has been collected and analyzed through the online survey service, it will be deleted.

Setting

The survey was sent to students through their personal password protected university associated email by an IRB approved manager. After reading information about the study, students voluntarily completed the survey and completion indicated acceptance of informed consent. Nursing students were able to complete the online survey at their convenience.

Sample

The subjects are current nursing students at the requested Carnegie Research University at the Junior and Senior level of the program. This survey will only include current nursing students and excludes any other subject in any other college or university.

Results

The results of this study are presented in Table 1 (Appendix A). There are currently 576 undergraduate nursing students enrolled in the nursing program that was used for this research. Fifty responses to the survey were collected and all participants agreed to informed consent; however, only forty-one responses were completed. The low response to the survey may be attributed to the research taking place during the COVID-19 crisis. The Junior and Senior semesters of nursing school are classified into J1, J2, S1, and S2, one title for each semester of the program. Of the 41 respondents; there were 46% of the participants were juniors, and 54% were seniors. Of the junior students, 34% were first semester nursing students, and of the participants 51% were senior students in their final semester of nursing school. The second question from the survey was a Likert scale question and read, "I understand the term chest tube drainage system and what that term means." 12% of people responded with strongly agree, 32% of people reported agree, 38% of people reported somewhat agree, 2% reported neither agree nor disagree, 10% reported somewhat disagree, 2% reported disagree, and 4% reported strongly disagree. The third question was a Likert scale and read, "I feel comfortable with what I have been taught about chest tube drainage systems in class." 0% of people put strongly agree, 20.8% put agree, 37.5% put neither agree nor disagree, 33% put disagree, and 8% put strongly disagree. The fourth question was a true or false question and stated, "I have

seen a chest tube system in the clinical setting.” 29.8% of people answered true and 70.2% of people answered false. The fifth question was a knowledge-based multiple-choice question which asked, “Which of the following is NOT considered a type of chest tube drainage systems.” 6.8% of people answered wet, 27.3% of people answered mini, 6.8% of people answered dry, and 59% people answered sinus. The sixth question was a Likert scale question and read, “I feel comfortable with my knowledge and ability to care for a patient with a chest tube drainage system.” 4.7% of people put extremely comfortable, 2% put moderately comfortable, 13.9% put slightly comfortable, 11.6% put neither comfortable nor uncomfortable, 16.3% put slightly uncomfortable, 27.9% put moderately uncomfortable, and 23.3% put extremely uncomfortable. The seventh question was a Likert scale question and stated, “If asked to record data from my assessment of a particular patient's chest tube drainage system in the clinical setting, I feel confident that I can successfully record the data accurately.” 2.4% of people put extremely confident, 14.3% put moderately confident, 26.2% put somewhat confident, 4.8% put no opinion, 16.7% put somewhat not confident, 9.5% put moderately not confident, and 26.2 put extremely not confident. The eighth question was a multiple-choice question and asked, “How is the chest tube inserted to connect to the pleural space?” 14.6% of people answered peripherally with a catheter, 80.5% answered with a Trocar through the ribs, and 4.9% answered through the stomach, up into the space. The ninth question was a multiple-choice question which asked, “The chest tube is connected to a _____ chest drainage system.” 24.4% of people responded with open and 75.6% responded with closed. The tenth and final question was a true or false question which stated, “The chest tube system has the ability to drain both air AND fluid.” 73.2% of

people who responded answered that this statement was true and 26.8% of people said that this statement was false.

Discussion

The 41 completed responses out of the possible 576 indicates a participation percentage of only 7.12%. Thus, it must be said that the results may not be a fair depiction of how the total population would have responded to each question. With regards to the term CTDS and what it means, a majority of people responded that they somewhat agree to having knowledge regarding understanding of the term. A majority of the people reported they neither agree nor disagree to feeling comfortable with what has been taught to them in class regarding CTDS. The second most popular answer for that question was disagree. When asked whether they have seen a CTDS in the clinical setting, a majority of those responding to the survey reported that they have not seen this kind of system before in the clinical setting. Regarding the first knowledge-based question, a majority of the participants answered the question correctly; these respondents understood that there is no such thing as a sinus CTDS. All of the other options listed are types of systems and all exist within the healthcare setting. When asked about their comfort level regarding their knowledge and abilities to care for a patient with a CTDS, a majority of participants reported feeling either moderately or extremely uncomfortable. This is cause for concern due to the increasing prevalence of these systems in non-intensive care areas, especially because new nurse graduates typically begin their career working in these areas. The participants reported that they are either extremely not confident or somewhat confident when it comes to recording observations of drainage from the CTDS. The second knowledge-based question analyzed participants'

understanding of how a CTDS is inserted. A large majority of participants correctly answered the question identifying that the CTDS is inserted using a Trocar and placed into the thoracic cavity. A majority of participants were able to identify correctly that CTDS are closed systems. The majority of people were also able to identify that CTDS have the ability to drain both air and fluid from the pleural space.

Future research should include metrics for level of progression in the nursing program. This would help clarify whether they are junior or senior students who feel more or less comfortable with CTDS. It is hypothesized that it is the senior students that possess more knowledge and feel more comfortable and confident with these devices seeing as they have had more clinical and didactic experience as compared with the first semester juniors. However, this is only able to be hypothesized and not proven due to the manner that the research was conducted.

Conclusion

There were 576 qualified potential subjects enrolled in the program. However, only a fraction above seven percent participated in the survey. Due to this fact, it is unfair to say that the results of this research are an accurate representation of the population as a whole. However, the data that was collected indicated many of the hypotheses from earlier to be true regarding the responses from the nursing students. Most of the student's surveyed were able to identify basic knowledge regarding CTDS which indicates that this hypothesis about the possible existence of a lack of basic knowledge was incorrect. However, a common theme found is that this knowledge has not led to confidence regarding care of the patient nor clinical understanding. These findings should bring to light that many students are inexperienced with CTDS and are uncomfortable, thus when

going into clinical experience or even the workforce they lack comfort, knowledge, and clinical expertise to feel as if they can properly care for a patient who has a chest tube drainage system. The results of this research may inform didactic and clinical instructors regarding students' perceptions and level of understanding of CTDS, which may assist when enhancing both didactic and clinical instruction.

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Appendix A

Table 1 Summary of Survey Responses

Question Items	Responses (n%) N=41				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
<i>I understand the term chest tube drainage system and what that term means.</i>	6 (14.6%)	35 (85.4%)	1 (2.4%)	5 (12.2%)	3 (7.3%)
<i>I feel comfortable with what I have been taught about chest tube drainage systems in class.</i>	-	10 (24.4%)	18 (43.9%)	16 (39%)	4 (9.8%)
<i>Assessing Confidence</i>	<i>Extremely/Moderately Confident</i>	<i>Somewhat Confident</i>	<i>Neutral</i>	<i>Somewhat Not Confident</i>	<i>Extremely/Moderately Not Confident</i>
<i>I feel comfortable with my knowledge and ability to care for a patient with a chest tube drainage system.</i>	3 (7.3%)	6 (14.6%)	5 (12.2%)	7 (17.1%)	22 (53.7%)
<i>If asked to record data from my assessment of a particular patient's chest tube drainage system in the clinical setting, I feel confident that I can successfully record the data accurately.</i>	7 (17.1%)	11 (26.8%)	2 (4.9%)	7 (17.1%)	15 (36.6%)
Demographics					
<i>Class Status</i>	<i>N</i>	<i>Percent (%)</i>			
<i>Junior 1</i>	8	19.5%			
<i>Junior 2</i>	5	12.2%			
<i>Senior 1</i>	8	19.5%			
<i>Senior 2</i>	20	48.8%			
<i>Which of the following is NOT considered a type of chest tube drainage system?</i>					
<i>Wet</i>	3	7.3%			
<i>Mini</i>	12	29.3%			
<i>Dry</i>	3	7.3%			
<i>Sinus</i>	26	63.4%			
<i>I have seen a chest tube system in the clinical setting.</i>					
<i>Yes</i>	14	34.1%			
<i>No</i>	33	80.5%			
<i>The chest tube system has the ability to drain both air AND fluid</i>					
<i>Yes</i>	30	73.2%			
<i>No</i>	11	26.8%			
<i>The chest tube is connected to a _ chest drainage system.</i>					
<i>Opened System</i>	10	24.4%			
<i>Closed System</i>	31	75.6%			
<i>How is the chest tube inserted to connect to the pleural space?</i>					
<i>Peripherally with a catheter</i>	6	14.6%			
<i>With a Trocar through the ribs</i>	33	80.5%			
<i>Through the stomach, up into the space</i>	2	4.9%			