# AUSCULTATING THROUGH A PATIENT GOWN

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## ABSTRACT

Purpose: Students are traditionally taught to auscultate with a stethoscope on bare chest. While, in practice many healthcare providers auscultate through clothing. Only two studies evaluated the ability to hear sounds when auscultating through fabric. The aim of this study was to determine if advanced practice nursing students could accurately assess heart and lung sounds through a patient gown using a stethoscope.

Theoretical Model: Sociocultural Theory states that human activities take place in cultural contexts, are mediated by language and other symbol systems, and can be best understood when investigated in their historical development. Based on this theory, nurses learn procedures by modeling instructor's behaviors and improve their skills under guided participation.

Participants: Advanced Practice students in Health Assessment, Primary Care I and Adult/Gero Healthcare I were invited to participate in this study.

Methods: This was a quantitative study evaluating the accuracy of advanced practice nursing students' assessments of recorded heart and lung sounds heard through a hospital gown compared to that heard directly on the chest wall of a manikin. During data collection, subjects were asked to identify three different heart sounds and three different lung sounds repeated randomly for a total of 5 assessments under each condition. The number of correct responses compared to incorrect assessments were calculated to determine if there was a significant difference with and without a gown.

Results: A total of 7 participants completed the study. There were a few errors, but most of the time subjects were accurate in their identification with both abnormal and normal heart and lung sounds both with and without the hospital gown. Some subjects stated that it was easier to hear without the gown, especially the heart sounds. Some also complained of the noise of the manikin motor.

Conclusions: Further study of this issue should be done with a larger sample size using heart and lung sounds from actual people.

# INTRODUCTION

Nursing students have traditionally been taught to always auscultate heart and lung sounds with a stethoscope applied to the patient's bare skin. In practice however, healthcare providers are often observed auscultating through the patient's gown. The assessment is done in this manner, often times due to its convenience. Very few studies have been done to determine if performing this vital procedure in this manner has a detrimental effect on practice and patient outcomes. The aim of this study was to determine if students in an advance practice nursing program taking Advanced Health Assessment and Clinical Reasoning, Primary Care I, and Adult/Gero Healthcare I could accurately assess lung and heart sounds though a patient gown using a stethoscope.

## REVIEW OF LITERATURE

A review of the literature revealed where and how to perform a pulmonary and cardiac auscultation. Many authors gave a detailed description of how to perform these assessments. While others identified the errors made by students and professionals and ways to correct these errors. The authors looked at how to improve teaching methods for healthcare professionals, but little is mentioned in literature about performing an auscultation assessment over clothing. Of the literature reviewed, only Jarvis (2012) and Reiner-Kent (2013) mention performing this assessment on bare skin. Only two studies were found that examined auscultation on fabric (Rankin, Rankin, & Rankin, 2015) (Kraman, 2008). In an editorial, Sherman (2009) scolds providers who auscultate over the patient's fabric. The author proceeded to state that even though there is little evidence to prove fabric does not interfere with cardiac or lung sounds, there is an increase in the number of providers auscultating through fabric.

A two-part series by Reimer-Kent (2013a) was designed to inform of different techniques providers can use to help improve the auscultating sound. One of the techniques listed focused on adequate exposure to the pericardium without interference from clothing and body hair. The first article part of this series also focused on demonstrating the basics of heart sounds and the heart's cycle in relation to the sound heard when auscultating. The author mentioned the importance of being able to master the understanding of cardiac anatomy and both its physiology and pathophysiology in order to fully differentiate the heart sounds and then recognize any abnormalities. Nurses that have not mastered this ability tend to have less confidence when it comes to stating their findings related to cardiac auscultation. Reimer-Kent (2013a) concluded that the lack in confidence these nurses' possess could lead to inaccurately performed examinations and inaccurate findings of cardiac abnormalities.

The second part to this series by Reimer-Kent (2013b) was designed to provide an overview of the anatomy and pathophysiology related to heart disease and the description of the heart sounds associated with different valve conditions. The author gave a short review of the anatomy of the aortic and mitral valves, followed by a short summary of systolic and diastolic murmurs. The author then focused on stenotic and regurgitant valvular heart disease. The author included a description of the pathophysiology of each one, followed by a description of the heart sounds associated with each valvular heart disease as well (2013b).

Nielsen, Mølgaard, Ringsted, & Eika (2010) designed an instrument for assessing cardiac auscultation skills of medical students and physicians that provided a high degree

of accuracy in the reproduction of normal heart sounds and murmurs, while also mimicking clinical situations. A goal for the instrument was to allow for convenient and cost effective standardized testing which would avoid the difficulties that using an actual patient may present. The study addressed the participants' ability to identify patients with cardiac murmurs among a group of persons with normal and abnormal heart sounds. The two-part test instrument used in this study was designed containing heart sound recordings from patients with common murmurs as well as patients with healthy cardiac sounds. The results showed there was a correlation between clinical experience and diagnostic ability. However, being able to distinguish abnormal murmurs from normal heart sounds seemed to be independent of clinical experience.

Germanakis, Petridou, Varlamis, Matsoukis, Papadopoulou-Legbelou, & Kalmanti, (2013) examined the performance of pediatricians in pediatric auscultation and the impact of a multimedia-based teaching intervention. The study included four multimedia-based pediatric cardiac auscultation teaching courses offered to 106 primary healthcare physicians within a two year period. The physicians were of different specialties and training levels, but all cared for pediatric patients either exclusively or partially. The courses were based on virtual patients' presentation and the participants' performance was evaluated at the beginning and the end of each course. At the end of the study it was noted that multimedia-based teaching was associated with a significant improvement in the detection of abnormal murmurs and additional sounds by the providers. However, the study showed the rate of innocent murmurs interpreted as abnormal did not change after the multimedia-based courses were offered. This study supported the use of multimedia-

based teaching interventions as an effective way to improve cardiac auscultation skills in pediatrics.

Kraman (2008) explored the assessment of artificial lung sounds through t-shirt material and through flannel. This study found flannel to be thicker, to have a greater negative effect on auscultation quality, and that low frequency sounds were harder to accurately assess. The author went on to warn of extraneous sounds mimicking crackles. He concluded that "[t]his study show[ed] that lung sounds are well transmitted through indoor clothing provided that extra force is applied to the stethoscope head" (Kraman, 2008, p. 88). This study, however, did not investigate auscultation of heart sounds through t-shirt material and flannel.

Only one research study (Rankin et al, 2015) explored the assessment of both lung and normal heart sounds through fabric. The aim of this study was to determine the impact on quality of the sounds this method had as well as how often physicians performed their assessment using this method. This study found that physicians were more "likely to listen to breath sounds than heart sounds through patients' gowns" (Rankin et al, 2015). The main reason physicians gave for performing auscultation over fabric was for compassion. Patient privacy was the first reason followed by patient immobility. Most physicians were not able to distinguish between sounds heard through a gown or skin (Rankin et al, 2015).

**THEORETICAL MODEL**

Sociocultural Theory states that human activities take place in cultural contexts, are mediated by language and other symbol systems, and can be best understood when

investigated in their historical development. Based on this theory, nurses learn procedures by modeling instructor's behaviors and improve their skills under guided participation.

# METHODS

## DESIGN

This quantitative descriptive study evaluated the accuracy of advanced practice nursing students' assessments of recorded heart and lung sounds through a hospital gown compared to the sounds heard directly on the chest wall of a high fidelity manikin.

## RESEARCH QUESTIONS

- Can practitioners accurately assess heart sounds through a patient gown?
- Can practitioners accurately assess lung sounds through a patient gown?

## INSTRUMENTS

The investigators developed a Data Sheet (Appendix A) to document the type of heart and lung sounds presented and the students' assessments of those sounds. The following three demographic questions were developed by the investigators and were asked:

- What month and year did you graduate as an RN?
- In what area do you work?
- How frequently do you auscultate heart and lung sounds per shift?

**SAMPLE**

Advanced practice nursing students in Health Assessment, Primary Care I, and Adult/Gero Healthcare I were invited to participate in this study. The assessment course has a laboratory component where students assess a manikin and each other. The other two courses have clinical experiences which include supervised assessment and care of patients.

**ETHICAL PERMISSION**

This study was approved by the Institutional Review Board (IRB) as an exempt study. Humans were not used as subjects to perform the assessments on, but students were used as participants within the study. In order to eliminate a power gradient, the course instructors did not receive data on who participated or how well they performed.

**PROCEDURES**

Advanced practice nursing students were taught heart and lung sounds in class and had the opportunity to practice auscultation of these sounds on the laerdal-high-fidelity manikins in the School of Nursing Clinical Learning Laboratory. Investigators informed students of the study during one of their classes and offered them the opportunity to participate. Informed consent was obtained from the participants the day they came to participate in the study.

Laerdal-high-fidelity manikins whose chests rise and fall, were used to generate the heart and lung sounds. Students used their own stethoscopes as they would when providing patient care or used a Littman Classic II if they did not bring one. The hospital gowns used in this study were obtained from hospital laundry. During data collection,

students were asked to identify three different heart sounds and three different lung sounds repeated randomly for a total of 5 assessments under each condition. They auscultated lung sounds first through the gown and then directly on the manikin chest wall. The students were not told in advance which sounds to expect. The order for each set of the sounds was randomly listed on the data collection form. This process was repeated for heart sounds. Subjects were not given feedback during data collection. The lung and heart sound level was predetermined by the investigators and remained constant throughout data collection. Subjects were asked the three demographic questions prior to auscultation and the assessments were documented on the Data Sheet by the investigators.

## RESULTS

A total of seven subjects participated in this study. There were a few errors, but the subjects were accurate in their identification with abnormal and normal heart and lung sounds both with and without the hospital gown most of the time. The participants made an error identifying the heart sounds on the manikin's chest wall on 3 out of the 35 (8.6%) assessments (Table 1) compared to 5 (14.3%) mistakes when auscultating through the gown (Table 2). There were four mistakes made identifying normal heart sounds on the chest wall as murmurs and one normal sound as atrial-fibrillation (Table 1). The mistakes made when auscultating through the gown were all identifying murmurs as normal heart sounds (Table 2). The subjects performed similarly when identifying lung sounds. There were 5 (9%) mistakes out of the 35 assessments identifying the lung sounds on the chest wall (Table 3). All of the participants that made a mistake in this condition identified rales as normal lung sounds (Table 3). The participants made 7 (20%) errors when auscultating

with a gown (Table 4). Three participants identified normal sounds as rales, one identified rales as normal, one identified wheezes as normal sounds, and two identified them as rales (Table 4).

## LIMITATIONS AND RECOMMENDATIONS

Some subjects stated that it was easier to hear without the gown, particularly for the heart sounds. The mechanics of the manikin made it hard for the participants to be able to determine if the additional noises were coming from the friction between the gown and the stethoscope or from the manikin. The participants took longer to identify the sounds with the gown on. This could have been due to this assessment being the first one performed on the manikin. Overall the participants took longer to perform the assessments than anticipated. It was anticipated that the assessment would take the participants approximately fifteen minutes, but it took them between twenty five to thirty minutes instead. The participants also seemed to have a difficult time identifying landmarks on the manikin both with and without the gown.

Due to the small number of participants the researchers were unable to perform a statistical analysis of the data collected for this study. The limitations of this study include the use of only one cohort of students at one university as a sample and therefore may not be generalizable to other programs. Further study of this issue should be done with a larger sample size. Furthermore, it is not possible to make any conclusions or recommendations.

However, it can be noted that healthcare providers may require more training on the assessment of heart sounds. The participants of this study had the most errors identifying murmurs as normal sounds. This is a similar finding to that of Rankin et al (2015) in their

study. Rankin et al (2015) only presented normal heart sound recordings to its participants, but many participants reported hearing added sounds. The most common sound reported by the participants was systolic murmurs. Future studies should evaluate the participants' auscultation skills and their ability to differentiate abnormal sounds. It may be necessary to offer them a course to help reduce the disparities between their abilities to recognize cardiac or lung abnormalities when auscultating in order to help reduce possible errors. Multimedia-based teaching such as that used by Germanakis et al. (2012) could be implemented in future studies in order to have a significant improvement in abnormal murmurs and additional sounds detected by the providers. The investigators also observed that none of the participants palpated landmarks to find the correct location for auscultation, which may have played a role in their ability to accurately identify the sounds.

There are many reasons why nursing students are taught to auscultate on bare skin, but not enough literature to prove this is best practice and results in best patient outcomes. Rankin et al would argue that "listening to heart sounds through a gown carries the risk of missing soft added sounds; listening to breath sounds adds the risk of mistaking sounds caused by the rubbing of gown on stethoscope as pulmonary crackles" (2015). The identification of best practice for this assessment is vital due to the importance of this clinical assessment. Even though there is an increase in the use of more advanced technology to help accurately diagnose patients by physicians, the stethoscope is the primary instrument available to nurses at the bedside. Nurses perform this clinical assessment multiple times per shift and it is very important that they do this using best practice.

# REFERENCES

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# APPENDIX A

Data Sheet

Assessment of Heart and Lung Sounds

**Demographics:**

1. What month and year did you graduate as an RN? _____
2. In what area do you work? _____
3. How frequently do you auscultate heart and lung sounds per shift? _____

Stethoscope _____

Sequence form _____

**Lung Sounds with Gown** Code: C = normal, clear W = wheezes R = rales, crackles

Played Assessed, Student statement

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Sequence form _____

**Lung Sounds on Chest Wall** Code: C = normal, clear W = wheezes R = rales, crackles

Played Assessed, Student statement

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Sequence form _____

**Heart Sounds with Gown** Code: N = normal, M = murmur S = atrial fibrillation

Played Assessed, Student statement

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Sequence form _____

**Heart Sounds on Chest Wall** Code: N = normal, M = murmur S = atrial fibrillation

| Played | Assessed, Student statement |
| --- | --- |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

# APPENDIX B

Table 1.

*Heart Sounds on Chest Wall*

| SUBJECT 1 | SUBJECT 2 | SUBJECT 3 | SUBJECT 4 | SUBJECT 5 | SUBJECT 6 | SUBJECT 7 |
|---|---|---|---|---|---|---|
| M | S->N | M | M | M | N | M-> N |
| S | N | N | M | S | M | S |
| M | S | M-> N | N | S | S | N |
| S | M-> N | S | S | N | S | M |
| N | M-> N | S | S | M | M | S |

*Notes.* N = normal, M = murmur, S = atrial fibrillation

Table 2.

*Heart Sounds with Gown*

| SUBJECT 1 | SUBJECT 2 | SUBJECT 3 | SUBJECT 4 | SUBJECT 5 | SUBJECT 6 | SUBJECT 7 |
|---|---|---|---|---|---|---|
| S | N | S<br>CANT HEAR-> S | N | N | S | N |
| S | M | S | S | M | N | M |
| N | S | M | S | S | M | S |
| M | S | N | M | M-> N | S | S |
| N | M-> N | M-> N | M-> N | S<br>VERY FAINT | M | M |

*Notes.* N = normal, M = murmur, S = atrial fibrillation

Table 3.

*Lung Sounds on Chest Wall*

| SUBJECT 1 | SUBJECT 2 | SUBJECT 3 | SUBJECT 4 | SUBJECT 5 | SUBJECT 6 | SUBJECT 7 |
|---|---|---|---|---|---|---|
| C | C | C | R | C | R | R |
| R | W | R->C<br>MECHANICAL NOISE | W | W | C | C |
| R | W | W | C | R | R | R |
| W | R->C | W | R | R | W | W |
| W | R | R->C | W | W | W | W |

*Notes.* C = normal/clear, W = wheezes, R = rales/crackles

Table 4.

*Lung Sounds with Gown*

| SUBJECT 1 | SUBJECT 2 | SUBJECT 3 | SUBJECT 4 | SUBJECT 5 | SUBJECT 6 | SUBJECT 7 |
|---|---|---|---|---|---|---|
| R | W | W | W-> R | W | W | W-> C |
| W | R->C | R | R | C | C->R | R |
| C | C | W | R | R | W | R |
| W | W | R | C-> R | R | R | C-> R |
| R | R | C | W | W | R | W-> R |

*Notes.* C = normal/clear, W = wheezes, R = rales/crackles