

Auditory Hallucination Simulation in The Medical School Curriculum: The Impact of Distressing Voice Simulations on The Empathy of Medical Students

Alyssa Davis ¹, Sonali Doshi ¹, Britta Eldridge ¹, Catherine Howell ¹, Carly Kelly ¹, Dr. Victoria Kelly ², Charlotte Lennox ¹, Dr. Chandani Lewis ², Kelly Morgan ¹, Dr. Thomas Roach ², Emma Wolinsky ¹

¹ University of Toledo College of Medicine and Life Sciences

² University of Toledo College of Medicine and Life Sciences Department of Psychiatry

Email: emma.wolinsky@rockets.utoledo.edu

Received 8/14/2024

Accepted for publication 1/30/2025

Published 7/26/2026

Abstract

Objective: Having an empathetic understanding of auditory hallucinations (AH) is a crucial skill for mental health professionals, significantly impacting patient outcomes. Simulation-based learning offers an opportunity to enhance medical education and foster greater confidence when interacting with individuals experiencing AH. This study aimed to investigate the impact of Auditory Hallucination Simulations (AHSs) on medical students' knowledge, attitudes, and empathy toward individuals experiencing auditory hallucinations.

Methods: 154 third-year medical students participated in a pre-simulation survey measuring empathy and attitudes. Students then completed an AHS experience followed by a post-simulation survey. Data was subsequently divided by participant demographics, specialty interest, and clinical rotation block.

Results: Overall, empathy scores significantly increased after the AHS experience. This increase was observed in both genders and was more pronounced among students interested in person-oriented specialties. No significant correlation was found between empathy scores and clinical rotation block.

Conclusion: This study suggests that AHS holds promise as a tool to enhance empathy in medical students, potentially impacting future patient care. However, limitations exist, including the study's single-institution nature and lack of long-term follow-up. Further research with larger, diverse samples and long-term assessments is recommended. Future studies could also explore the impact of AHSs within specific specialties.

Keywords: Auditory Hallucinations, Simulation, Medical Student, Empathy

1. Introduction

Auditory hallucinations (AH) account for 64-80% of hallucinatory modalities and are among the most distressing symptoms experienced by individuals with schizophrenia spectrum disorders (1,2). In some cases, AH may be temporary and respond to treatment. However, in patients with treatment resistant AH, significant challenges are posed for both individuals with mental illness and their healthcare providers such as maintaining a longitudinal relationship which can be exacerbated or made difficult by a general lack of empathy. Studies have shown that healthcare professionals feel uncertain about how to interact and approach individuals experiencing AH and often feel as though they can do very little to help (3). These uncertainties stem from a lack of education and adequate training in handling individuals experiencing AH. To bridge this gap, experiential learning techniques such as auditory hallucination simulations (AHSs) have emerged as promising tools for enhancing healthcare professionals' empathy and understanding towards individuals with mental illness experiencing AH.

Prior studies have indicated a potential benefit of AHSs in nursing education as they found significant improvements in both knowledge and empathy toward individuals with a mental illness, not just those with AH (4,5). In addition, many nursing students noted that their preconceived notions and stigmas against persons experiencing AH were inaccurate, and this experience allowed them to exhibit more positive attitudes when it came to developing a treatment plan (4,5). This deeper understanding, in turn, fosters greater confidence when interacting with patients, ultimately leading to improved patient care (3).

Despite positive findings in nursing education, there is still a critical gap in our understanding of how AHSs impacts medical students. It is crucial for physicians in training to have an empathetic understanding of severe mental illness to diminish any biases or negative attitudes before going into practice (6). In a previous study, it was found that medical students experience increased empathy after listening to AHSs (7). Another study determined medical students completing various tasks while experiencing the AHSs exhibited an increase in empathy for individuals with mental illnesses experiencing AH, however, the study is limited due to their lack of baseline and absence of control groups (8). Currently, there is a lack of information

on medical students' attitudes towards mental health experiences prior to undergoing AHSs. Due to the differences in training and skillset between nursing and medical students, it is essential that the impact of AHSs is specifically researched in medical students.

This study aims to better gauge the implications of AHSs on the knowledge, attitude, and empathy of medical students participating in a psychiatric didactic during 3rd year clerkships. This exploration holds significant promise for improving the mental health outcomes of individuals experiencing AH through allowing future physicians to understand the lived experiences of their patients in a moderated controlled setting.

2. Methods

Approval from the Social and Behavioral Sciences committee Institutional Review Board (IRB) was obtained prior to data collection. This study took place in a simulated home care environment within the Lloyd Jacobs Interprofessional Immersive Simulation Center at the University of Toledo College of Medicine and Life Sciences (UT-COMLs). Staff monitored the simulated home care environment via a one-way mirror throughout the simulation. Inclusion criteria included third-year medical students at UT-COMLs rotating through their required psychiatry clerkship. Participation in the simulation was mandatory as a required portion of the clerkship, while participation in the research study was voluntary. Students were given the opportunity to opt out of the experience if requested. First, students were given a multi-question pre-simulation survey and asked to complete Likert Scale ratings (1-5; Strongly Disagree to Strongly Agree) based on their beliefs, attitudes, and empathy toward people experiencing auditory hallucinations (*refer to Table 1*). A higher rating was associated with a higher score of empathy. Surveys were administered by the simulation center staff and responses were returned to the investigators without identifying information to preserve anonymity of the participants. Demographic information was also collected on this survey including race, sex, age, gender, specialty of interest, and which block of clinical rotation that student was in. Following completion of the pre-simulation survey, students worked in pairs and rotated through five workstations within the simulated home care environment, during which they heard auditory stimuli through headphones.

Table 1. Table of questions 1-11 provided on the pre and post simulation survey completed with a Likert Scale (1 – Strongly Disagree; 5- Strongly Agree).

Pre and Post Simulation Quantitative Survey Questions
I. I believe that a person experiencing hallucinations could have difficulties performing activities of daily living.
II. I believe that a person experiencing hallucinations could have difficulty communicating.
III. I believe that a person experiencing hallucinations could have difficulty regulating mood.
IV. I believe that a person experiencing hallucinations could have difficulties performing tasks that require spatial processing skills
V. I believe that a person experiencing hallucinations could have difficulties performing tasks that require concentration
VI. I believe that a person experiencing hallucinations could have difficulties performing tasks that require memory.
VII. I believe that a person experiencing hallucinations could have difficulties performing tasks that require critical thinking skills.
VIII. I have compassion (concern for and desire to alleviate the suffering of others) towards people who experience hallucinations.
IX. I have empathy (the ability to identify and understand another person's feelings and perspective) towards people who experience hallucinations.
X. I believe that having empathy towards people who experience hallucinations improves my ability to care for patients.
XI. Experiencing simulated hallucinations will improve my empathy towards my patients.

The auditory stimuli began with calm voices and mild background noise but escalated to disruptive voices that would give commands. The workstations were designed to challenge the students' skills in communication, critical thinking, spatial processing, concentration, and memory all while experiencing disruptive auditory hallucinations. Tasks included mixing baby formula, calculating distances on a map, interacting with a peer to play a board game, completing a table of information about medications, and answering questions about a news clip played on a television screen. After completing all five workstations, students were given an identical post-simulation survey and had the opportunity to debrief with the clerkship director. Participants completed the simulation experience in cohorts referred to as blocks. A student in the block 1 cohort was rotating through Psychiatry as their first clinical rotation while a student in the block 10 cohort had completed 9 other clinical rotations before rotating in Psychiatry- meaning the students in higher blocks had more previous patient exposure than students in earlier blocks. Block 9 was omitted due to the COVID-19 pandemic. All data analyses were

completed in excel with a set p-value of .05 as the level of significance.

3. Results

3.1) Demographics

Table 2 presents the population demographics of study participants. 154 medical students completed the voluntary study. Ages of the participants ranged from 22 to 43 years of age, consisting of 53.2% males and 46.1% females (0.6% did not report). 61% of participants self-identified as White while 31.2% self-identified as Asian and 3.9% self-identified as Black/African American. 4% of the study participants did not report their race on the survey. In regard to the sample size, 154 pre-surveys and 137 post-surveys were used for our study. Additionally, one student indicated they were non-binary and were not included in analyses within or between genders.

3.2) Empathy Scores by Future Specialty of Interest

Participants reported what specialty they were interested in on the pre-simulation survey. Specialty type was determined based upon a 2009

Table 2. Demographics of the study population including race, sex, and age.

Demographic		Number reported	Total percentage
Race	White	94	61.0%
	Black/African American	6	3.9%
	Asian	48	31.2%
	Not reported	6	3.9%
	Total	154	100%
Sex	Male	82	53.2%
	Female	71	46.1%
	Not reported	1	0.6%
	Total	154	100%
Age	22-24	52	33.8%
	25-27	78	50.6%
	28-30	18	11.7%
	31+	5	3.2%
	Not reported	1	0.6%
	Total	154	100%

study in *Medical Education Online* as person-oriented (family medicine, internal medicine, psychiatry, OBGYN, pediatrics, and PMR) or technique-oriented (emergency medicine, surgery, anesthesiology, dermatology, pathology, radiology, ENT, ophthalmology, and neurology). Students who marked more than one specialty of interest were not included in this analysis leading to a study population of 119. From the study population, 43% of participants reported technical-oriented specialty interests while 57% reported person-oriented specialties.

An independent t-test was utilized, showing that the intervention led to a statistically significant increase in empathy scores for the group of students who were interested in person-oriented specialties (n=67). However, there was no statistically significant change in empathy scores in students interested in technique-oriented specialties (n=52).

3.3) Empathy Scores by Clinical Block

Participants completed the simulation experience while participating in varying medical rotation blocks ranging from 1-10 (block 9 excluded due to COVID pandemic). A participant in a further block indicates someone who has spent a longer time on clinical rotations. A Spearman correlation analysis was run to assess for a

potential correlation between average empathy scores, and the specific rotation block that participants were in. In other words, to assess if students who had been around patients for a longer amount of time exhibit higher empathy scores than their peers who were newly interacting with patients. The Spearman correlation analysis indicated that rotation block was not significantly associated with empathy scores in the pre-simulation survey ($p = 0.30$) or post-simulation survey ($p = 0.84$) denoting that students further along in their rotations had either more or less empathy than their peers in earlier rotations either before or after participating in AHSs. The Spearman correlation data was then used to plot mean empathy score (y-axis) vs. the clinical rotation block (x-axis). The trendline showed the moving average empathy score for each block. In both pre and post-survey scores there was not a clear trend (i.e. Block 2 had higher pre-survey empathy scores while Block 6 had lower pre-empathy scores but then scores went back up during Block 8 pre-survey empathy scores, seen again in the post-survey scores), further showing that block number/amount of time spent on rotations was not consistently associated with a

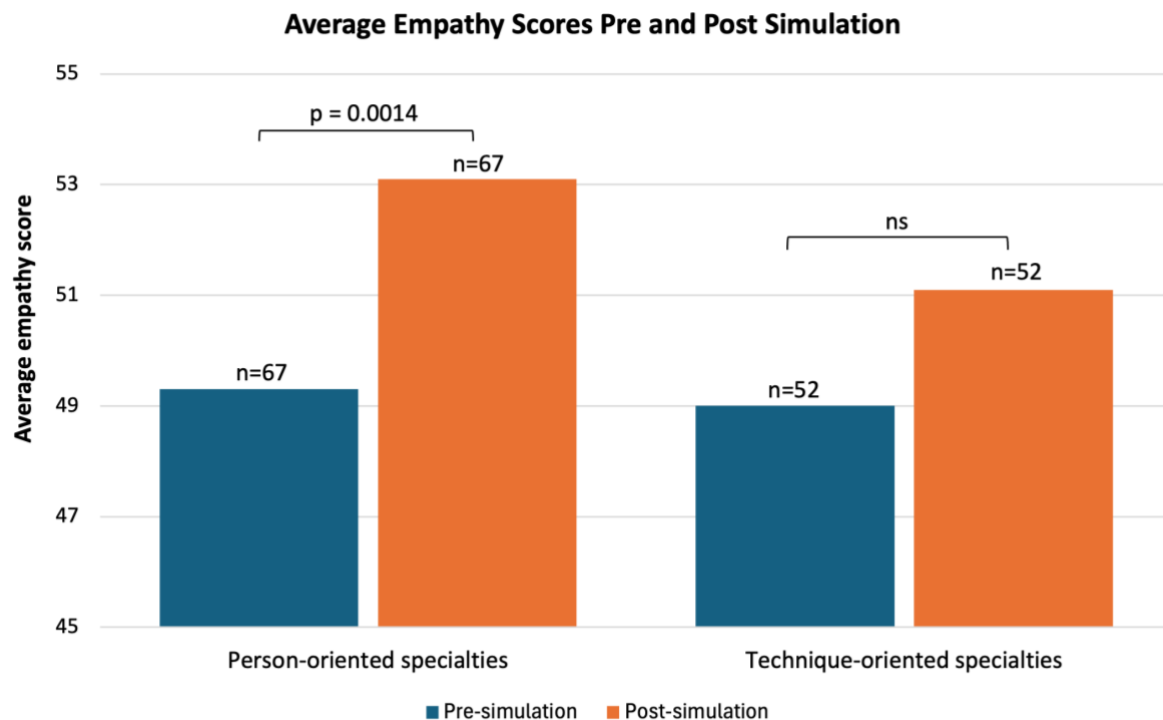


Figure 1. Average empathy scores for the pre and post simulation survey for participants interested in person vs. technique-oriented specialties. P-values were calculated using an independent two sample t-test. A significant increase (p-value <0.05) in average empathy scores was found for the students who were interested in person-oriented specialties, while there was no significant difference in empathy scores for the students interested in technique-oriented specialties.

significant change in empathy scores. Block 9 was excluded due to the COVID-19 pandemic.

3.4) Empathy Scores by Gender

Average empathy scores for before and after the simulation were compared using an independent two sample t-test both within and between gender (Table 3).

Column 2: Average empathy scores from the pre simulation survey (n= 154) were compared to the average empathy scores from the post simulation survey (n=147) combining both male and female participants. A significant p-value of < 0.0001 was found for this group indicating an overall increase in average empathy score after undergoing the simulation.

Column 3: Average female empathy scores from the pre simulation survey (n=71) were compared to the average female empathy scores from the post simulation survey (n=69), and a significant p-value of 0.0009 was calculated indicating an overall increase in average empathy scores within the female only participants.

Column 4: Average male empathy scores from the pre simulation survey (n=82) were compared to the average male empathy scores from the post simulation survey (n=77), and a

significant p-value of 0.0128 was calculated showing an overall increase in average empathy scores within the male only students.

Column 5: Average empathy scores from the pre-simulation survey were calculated and divided by gender. No significant results were found, meaning that neither females nor males started off with “more” or “less” empathy than their counterparts.

Column 6: Average empathy scores from the post-simulation survey were calculated and divided by gender. No significant results were found meaning that neither females nor males ended the simulation with “more” or “less” empathy than their counterparts.

4. Discussion

Our study emphasizes the utility of experiential learning to confront the stigma of mental illness in healthcare providers through the finding of increased empathy scores among medical students. There was a significant increase in empathy scores across all post-simulation surveys suggesting that when students experience their patients’ reality firsthand, their empathy towards these patients increases (7). This

Table 3. Table summarizing p-values calculated using an independent two sample t-test. Row four indicates the two average empathy scores for each comparison group. Significant values (p-value <.05) are denoted by an asterisk. Groups with significant p-values included: pre vs post empathy scores for females and males combined, pre vs post empathy scores for females only, and pre vs post empathy scores for males only. All groups had a higher post average empathy score, indicating a significant increase in empathy scores for these groups.

	Pre vs Post Empathy Scores						Pre-simulation Only Scores		Post Simulation Only Scores	
Comparison Group	Females and Males		Females Only		Males Only		Females vs Males		Females vs Males	
P- value from T-Test	*< .0001		*.0009		*.0128		.3100		.3469	
Average empathy scores for each comparison group	Pre	Post	Pre	Post	Pre	Post	Pre-F	Pre-M	Post-F	Post-M
	49.0	52.3	50.3	53.2	48.0	52.1	50.4	48.3	53.0	52.1

experience may also encourage students to confront their pre-existing bias towards the mentally ill population and better understand their patients' experiences (4,9). This additional understanding of the challenges their patients face daily could improve students' abilities to provide appropriate patient-centered care as seen in the incorporation of AHs in nursing education (4,9). Students reported that their preconceived notions and stigmas against persons experiencing AH were inaccurate, and this experience allowed them to exhibit more positive attitudes when it came to developing a treatment plan (4).

By categorizing specialties into person-oriented and technical-oriented, we were able to observe the differences in survey responses between these two groups. While there was a significant increase in post survey empathy scores in the person-oriented specialties, we did not detect a significant increase in the post survey scores in technical oriented specialties. This finding could suggest that students interested in technical-oriented specialties may not view empathy as an integral part of their practice to the same degree as those in person-oriented specialties (i.e. prioritizing physical skill over empathizing). Empathy is important for promoting effective physician-patient communication and may be a skill more heavily relied upon in these patient-

oriented specialties (11). However, communication is vital for all medical specialties and thus this data may suggest a need for additional empathy training in students interested in technical-oriented specialties. Similarly, students and physicians not directly interested in psychiatry may have limited training opportunities directed towards mentally ill patients yet will still be tasked with caring for this population throughout their career (12). Thus, current medical faculty need to be aware that AHSs may not have the same impact or result on all students equally and may increase stigma in students who perceived the simulation as a negative experience rather than an educational one (8).

There was also a statistically significant increase in female's empathy scores as well as male empathy scores across pre and post simulation surveys, but females had higher averages on the pre and post simulation surveys when compared to their male counterparts. However, when comparing males to females for both pre- and post-simulation scores, we did not detect a significant difference. Thus, although the higher averages among females may suggest that they are more likely to empathize with their patients than their male peers, the absence of statistically significant findings indicates that more data is needed to make a definitive conclusion.

Further, there were fewer males than females included in the study, which could have affected these averages. Finally, our study analyzed how students' empathy scores correlated with the block during which they participated in the simulation to evaluate if time spent on clinical rotations affected empathy scores. We did not detect a statistically significant correlation, suggesting that additional curricular clinical experience does not impact students' likelihood to empathize with mentally ill patients. If additional curricular clinical exposure does not significantly impact empathy scores, it is possible that the societal stigma surrounding individuals with mental illness could be a primary factor affecting attitudes towards them amongst healthcare professionals. This finding further emphasizes the potential efficacy of experiential learning to confront the preconceived notions students may have about mental illness to promote more effective patient care.

While the significant results from this study yielded information that can help guide future psychiatric clinical curriculums, our study had several limitations. Data collection was limited to third year medical students at the University of Toledo College of Medicine and thus may not generalize to other medical schools or professions. The study sample was taken from students rotating through psychiatry clerkship in one year. Further, the surveys relied on self-reporting, which can be subject to bias. Finally, the post-survey was administered to students directly after completing the simulation and there was no long-term follow up. While this timeline provided insight into the students' immediate reactions, it did not allow for surveillance of long-term effects of the study. To address this limitation, we suggest expanding upon the study by including an additional survey after one year to provide insight on the long-term effects of the study. Further, while the pre and post surveys were not matched to preserve student anonymity, it impeded our ability to track intrapersonal changes. Implementing de-identified data markers to track intrapersonal changes before and after the simulation would provide additional beneficial insight. Finally, our data analyses were limited to analyzing changes in scores among large groups of specialties, rather than within individual specialties themselves (i.e., person-oriented specialties vs internal medicine). A potential direction we recommend would be increasing the study's sample size to allow for enough data collection to analyze changes in scores within a specific specialty.

In conclusion, our study supports the utility of experiential learning to increase awareness and promote empathy in medical students through the findings of increased empathy scores following simulated auditory hallucinations. The stigma surrounding mental illness is widespread throughout society and could impact the attitudes of individuals that may one day be caring for patients with mental illness. Confronting the preconceived notions that students have about these conditions through experiential learning has the potential to promote understanding and empathy to improve care for the mentally ill population (13). Based on the value of experiential learning, medical school programs should consider integrating educational practices such as this in their curriculum. The curriculum intentionally paired AH with stations that would require executive functioning skills to execute tasks to help students understand the cognitive burden that AH can cause which could also be useful in other programs, including residency, nursing, and pharmacy. We hope that integrating experiential learning simulations into curriculums will help students gain a better understanding of their patients' experiences so that they may approach their patients with a more empathetic mindset to improve patient care in the mentally ill population.

References

1. Hugdahl K, Loberg EM, Specht K, Steen VM, van Wageningen H, Jorgensen HA. Auditory hallucinations in schizophrenia: the role of cognitive, brain structural and genetic disturbances in the left temporal lobe. *Front Hum Neurosci.* 2007;1:6.
2. McCarthy-Jones S, Smailes D, Corvin A, Gill M, Morris DW, Dinan TG, Murphy KC, Anthony O Neill F, Waddington JL, Australian Schizophrenia Research Bank, Donohoe G, Dudley R. Occurrence and co-occurrence of hallucinations by modality in schizophrenia-spectrum disorders. *Psychiatry Res.* 2017 Jun;252:154-160. doi: 10.1016/j.psychres.2017.01.102. Epub 2017 Feb 24. PMID: 28273630.
3. McCluskey A, Watson C, Nugent L, O'Connor T, Moore Z, O'Brien N, et al. Psychiatric nurse's perceptions of their interactions with people who hear voices: A qualitative systematic review and thematic analysis. *J Psychiatr Ment Health Nurs.* 2022;29(3):395-407.

4. Kepler BB, Lee H, Kane I, Mitchell AM. Voice Simulation in Nursing Education. *Nurse Educ.* 2016;41(2):66-9.
5. Mawson K. Use of media technology to enhance the learning of student nurses in regards to auditory hallucinations. *Int J Ment Health Nurs.* 2014;23(2):135-44.
6. Galletly C, Burton C. Improving medical student attitudes towards people with schizophrenia. *Aust N Z J Psychiatry.* 2011;45(6):473-6.
7. Bunn W, Terpstra J. Cultivating empathy for the mentally ill using simulated auditory hallucinations. *Acad Psychiatry.* 2009;33(6):457-60.
8. Smith MK, Tamburrino MB, Naskar I, Lynch DJ, Chen Y. Hearing voices: evaluation of a medical student training experience about psychosis. *Acad Psychiatry.* 2014;38(4):514-5.
9. Hull SK, Broquet K. How to manage difficult patient encounters. *Fam Pract Manag.* 2007;14(6):30-4.
10. Casas RS, Xuan Z, Jackson AH, Stanfield LE, Harvey NC, Chen DC. Associations of medical student empathy with clinical competence. *Patient Educ Couns.* 2017;100(4):742-7.
11. Hojat M, Gonnella JS, Mangione S, Nasca TJ, Veloski JJ, Erdmann JB, et al. Empathy in medical students as related to academic performance, clinical competence and gender. *Med Educ.* 2002;36(6):522-7.
12. Wieland D, Levine C, Smith J. Hearing distressing voices clinical simulation: "life changing" experiences of psychiatric-mental health nursing students. *J Psychosoc Nurs Ment Health Serv.* 2014;52(10):42-51.
13. Lee MF, Lin CE. [The Effects of Auditory Hallucination Simulation on Empathy, Knowledge, Social Distance, and Attitudes Toward Patients With Mental Illness Among Undergraduate Students: A Systemic Review and Meta-Analysis]. *Hu Li Za Zhi.* 2017;64(5):59-68.