

Evaluation of a short-term ultrasound curriculum on promoting interest in healthcare and sciences for deaf and hard of hearing students

Ultrasound curriculum for deaf and HoH students

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Abstract

Purpose – The objective of this study was to determine if exposure to a short-term ultrasound basic biology and anatomy course can promote interest in health careers and other science-related endeavors among DHH students.

Design/methodology/approach – This was a single-site, prospective observational study of DHH high school students at a Southern California high school. All participants took a pre-test survey prior to the course. Participants then took part in three teaching sessions which taught basic anatomy using point-of-care ultrasound (POCUS). Following instruction, a post-test survey was performed to determine if students had an increased interest in medicine, science and biology ($p = 0.151$).

Findings – 28 students were enrolled in the study, with an equal distribution of boys and girls. Initially, subjects reported their interest in medicine at an average of 2.8 ± 1.10 . The reported interest in science was 3.0 ± 1.13 and for biology was 3.0 ± 1.19 . The change in participants' interest was not statistically significant for medicine ($p = 0.791$), science ($p = 0.225$) and biology.

Practical implications – While our data did not demonstrate a statistically significant difference in students' interest in STEM fields after the training course, there were several students who were interested in more hands-on shadow experience after the course. Regardless, this study demonstrates persistent barriers that exist for a person who is deaf or hard of hearing to engage in the STEM fields. Future studies are needed to determine the level of instructional activities that may impact the careers of these students.

Originality/value – Point of care ultrasound has been shown to be an effective teaching modality in medical education. However, to date, no studies have been done to assess the utility of ultrasound in teaching the Deaf and Hard of Hearing (DHH) population.

Keywords STEM, Deaf, Hard of hearing, Ultrasound applications

Paper type Theoretical paper



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Introduction

Ultrasound has shown promise as an effective teaching modality in medical education (Hoppmann *et al.*, 2011; Rao *et al.*, 2008). In recent years, this tool has gained traction and is now implemented regularly in both early and late medical education (Bahner *et al.*, 2013; Fox, 2017; Bahner and Royall, 2013). Medical schools such as UC Irvine, Ohio State and the University of South Carolina have fully integrated ultrasound into their early medical education curricula (Bahner and Royall, 2013; Bahner *et al.*, 2014). Ultrasonography not only serves as a teaching tool to be used in basic science courses to learn anatomy and physiology more comprehensively (Hoppmann *et al.*, 2011) but also provides the necessary information to make clinical decisions (Hoppmann *et al.*, 2011; Rao *et al.*, 2008). Current studies have demonstrated the ease of teaching ultrasound to premedical and medical students because of its ability to engage the audience with visuals and real-life application of science concepts (Bahner *et al.*, 2013; Fox *et al.*, 2014). This early training enhances their ability to detect medical problems quickly, non-invasively and at a reasonable cost, as evidenced by medical student-identified pediatric cardiac pathology via ultrasound in rural Panama (Miner *et al.*, 2015).

Similarly, studies have also demonstrated that ultrasound has also been shown to be versatile in a variety of settings. Studies by Lee *et al.* (2017) and Denny *et al.* (2018) articulate the utility of ultrasound educational workshops taught by English-speaking medical students to providers in Indonesia and Tanzania (Lee *et al.*, 2017; Denny *et al.*, 2018). Because of the success of ultrasound education within medical education curriculums (Fox *et al.*, 2014), efforts to integrate ultrasound into more creative settings, such as undergraduate and high school basic sciences curricula, have shown promising benefits as well (Kwon *et al.*, 2019). Kwon *et al.* (2019) described middle schoolers learning ultrasound and demonstrating an ability to obtain clinically adequate FAST ultrasound images after minimal training (Kwon *et al.*, 2019). Thus, it has become apparent that with the right opportunities and skills, a variety of learners, regardless of training or experience, are capable of learning ultrasound.

Concurrently, it has been widely recognized, that the fields of science, technology, engineering and mathematics, also known as “STEM,” have been largely under-representative of minorities and disabled individuals (Braun *et al.*, 2017). Specifically, a 2010 US census estimates that physicians comprise about 6.2% of hearing persons employed in the healthcare industry, but only 4% of Deaf and Hard of Hearing (DHH) healthcare workers were physicians (McKee *et al.*, 2013). In spite of this lack of representation within medicine, an estimated 20 million Americans have some form of hearing loss: a spectrum ranging from complete deafness to individuals hard of hearing (hearing loss where there may be salvageable residual hearing through the use of an auditory device) (Scheier, 2009; How are the terms deaf and deafened . . . , 2019). And while the passage of the Americans with Disabilities Act in 1990 (ADA) did allow for healthcare to become more accessible for deaf and hard of hearing patients, there remains persistent healthcare barriers for this population (Barnett, 2002).

According to Wells and the National Science Foundation, “only 4.8% of students enrolled in graduate and engineering fields identify as having a disability” (Wells and Kommers, 2020). While a lack of representation in the STEM fields remains within the disabled community, there are several studies that have shown that if efforts are made for improved integration or cultural competence, there are demonstrably better outcomes within the DHH communities (McKee *et al.*, 2013; Barnett *et al.*, 2011; Steinberg *et al.*, 2006; Meeks *et al.*, 2018). McKee *et al.* (2013). finds that in fact there is improved engagement with DHH patients who have DHH physician providers: with outcomes reflecting improved patient compliance with healthcare recommendations or medications, positive healthcare experiences and/or appropriate activation use of healthcare services and facilities (McKee *et al.*, 2013; Meeks *et al.*, 2018; Moreland *et al.*, 2013). There is power in representation: as several studies indicate

that a mentored research experience can inspire the next generation to engage with a career in STEM (Braun *et al.*, 2017; Gregerman *et al.*, 1998; Hathaway *et al.*, 2002). Braun *et al.* (2017) echo this sentiment in their study, finding that mentorship and community outreach can have important implications towards improving deaf and hard of hearing student engagement within STEM (Braun *et al.*, 2017; Wells and Kommers, 2020). A greater awareness of the paucity of both research and opportunity for the disabled at the graduate education level can help motivate and activate changes within the educational community (Wells and Kommers, 2020). These observations as well as what Meeks *et al.* (2018) comments as, “a renewed interest in disability access and a commitment to social justice” have ultimately allowed for “increased efforts toward the inclusion of individuals with disabilities in medical education and training” (Meeks *et al.*, 2018).

Overall, a push towards more diversity of representation in our healthcare providers coupled with evolving and advancing technology, has allowed for improved methods of communication between providers and DHH patient populations (Garberoglio *et al.*, 2015). In particular, ultrasound, as both a portable and visual technology, has largely been regarded as a way to enhance patient experience at the bedside to better explain pathology to patients (Howard *et al.*, 2014; Claret *et al.*, 2016). In the same vein, Garberoglio comments that perhaps technologies can “reduce communication barriers and level the playing field for deaf individuals” (Garberoglio *et al.*, 2015). It is with this reasoning, that we believe integrating ultrasound into education for DHH students may serve as an additional mechanism to inspire others to pursue an interest in the fields of STEM.

This pilot study attempts to introduce a short-term ultrasound curriculum into the high school science courses of DHH students to provide a bridge across language barriers. We hypothesize that the integration of ultrasound in the pre-medical education system will lead to an increase of interest of DHH students to follow careers in the fields of STEM. The objective of this study is to determine if an ultrasound basic curriculum given to DHH students can influence students to pursue higher education and careers in science or medicine.

Methods

Study design and ethical considerations

This was a prospective, observational study utilizing a convenience sample of high school students at a single high school dedicated to the education of DHH students. Prior to enrollment or consent, the study was approved by the site and local Institutional Review Board. The students had the opportunity to voluntarily participate in the study with consent from their parents/guardians. Both written and verbal consent was obtained from subjects and parents/guardians prior to enrollment in the study or course.

Subject recruitment and selection of subjects

All high school students from the Southern California area (aged 14–18) currently enrolled in the honors science curriculum at the DHH institution were invited to voluntarily participate in the study. This specific cohort of students was chosen in an effort to ensure that the focus was placed on students more likely to express a desire in entering a STEM career field, a decision made by the teachers at the school and the interests they knew their students had. Exclusion criteria included any student not currently enrolled in the honors science curriculum or any student who did not voluntarily agree to the study consent.

Study implementation/workflow

Prior to the first teaching course, all subjects participated in a baseline Pre-Interest survey that assessed the students’ interests in the sciences, biology or intention to pursue a career in

medicine. Following the survey, a total of three lectures were given one month apart by the study instructors. Group instructors included medical students, licensed sonographers, and emergency medicine physicians. First, a 30-min lecture focusing on basic human anatomy of the session's subject matter was presented. As mentioned, there were three science and anatomy sessions:

- (1) Session 1: Ultrasound basics, Abdominal Ultrasound (Gallbladder, Kidney, and Bladder)
- (2) Session 2: Ocular Ultrasound, Skin and Muscle
- (3) Session 3: Cardiac Ultrasound and Pathology

The first lecture was performed via verbal translation and by writing on the white board. However, after receiving feedback from the teachers, they stated that the students preferred visual lessons because of their learning habits and preferences. So for the next two sessions our team made PowerPoint presentations. In addition, one session featured a radiologist physician who is deaf and who was able to act as a mentor and example of what individuals of the DHH community can achieve. She spoke about her experiences as a physician who is deaf and how she overcame disabilities or any challenges as an individual who is DHH. Throughout each lesson, a sign language interpreter (certified and provided by the school) was used to assist in translation. Following the lecture portion, students were provided 20 min to ask questions. Again, professional and certified interpreters were provided by the institution to facilitate communication.

Afterwards, small groups were created for two hours of hands-on teaching sessions. There were four ultrasound models for the students to practice the ultrasound skills training for image acquisition. The ratio of students to instructors was six to one. Students were able to manually use the ultrasound and, with guidance, able to learn to visualize the organs discussed on the live ultrasound models provided. This tactile and translational learning experience was a hands-on application of the basic anatomy lessons they learned through our instruction sessions. Following the final lecture, all subjects participated Post-Interest Survey to assess any changes in their interests in the sciences, biology, or intention to pursue a career in medicine. They were asked to report their knowledge and interest based on a Likert scale that was described from a range of 1–5. 1 was used to represent the “Least interested” and 5 was used to represent the “Most interested.”

Privacy considerations

The Pre-Interest and Post-Interest Survey data were collected via paper surveys, which were then inputted onto a Microsoft Excel document using the unique identification numbers to ensure the data could not be traced back to the participant. Each enrolled student was provided a unique identification number to be used for all surveys ensuring de-identification. A code key linking student numbers and study specific numbers were kept separate from all exams and surveys. All exams and surveys were stored in a locked cabinet in a locked room of the PI. Only applicable research personnel had access to the code key.

Data analysis

Participants' initial interest in medicine, science and biology as well as their knowledge in ultrasound is reported as mean \pm Standard Deviation (SD) and median (Inter Quartile Range (IQR)). The distribution of the reported scores was compared with normal distribution by using One-Sample Kolmogorov–Smirnov Test. Since the scores were not distributed normally, we used Related-Samples Wilcoxon Signed Rank Test to test the change in reported interest after the intervention compared with the initial interest. A p -value <0.05 was

considered statistically significant. All statistical analyses were performed using SPSS statistics 26.0 for windows.

Results

28 students were enrolled in the study, with an equal distribution of boys and girls. Initially, subjects reported their interest in medicine at an average of 2.8 ± 1.10 (median = 3.0, IQR: 2.0–4.0). The reported interest in science was 3.0 ± 1.13 (median = 3.0, IQR: 2.8–4.0) and for biology was 3.0 ± 1.19 (median = 3.0, IQR: 2.0–4.0). The participants' knowledge score on ultrasound was 3.2 ± 1.42 (median = 3.5, IQR: 2.0–4.0).

Five (22.7%) participants reported an increase in their interest in medicine while 5 (22.7%) other reported a decrease. Twelve (54.5%) participants reported no change in their interest in medicine (Figure 1) and 6 did not answer to this question. The change in participants' interest in medicine was not statistically significant ($p = 0.791$).

Ten (47.6%) participants reported an increase in their interest in science while 4 (19.1%) reported a decrease. Seven (33.3%) participants reported no change in their interest in science (Figure 2) and 7 did not answer to this question. The change in participants' interest in science was not statistically significant ($p = 0.225$).

Two (10.0%) participants reported an increase in their interest in biology while 6 (30.0%) reported a decrease. Twelve (60.0%) participants reported no change in their interest in biology (Figure 3) and 8 did not answer to this question. The change in participants' interest in biology was not statistically significant ($p = 0.151$).

Discussion

To our knowledge, this is the first study to implement ultrasound education into a high school student science curriculum for students who are DHH. Utilizing POCUS in this setting was unique given the visual nature of the diagnostic tool and its previous evidence of crossing language barriers in global settings. For all enrolled students, this course was their first

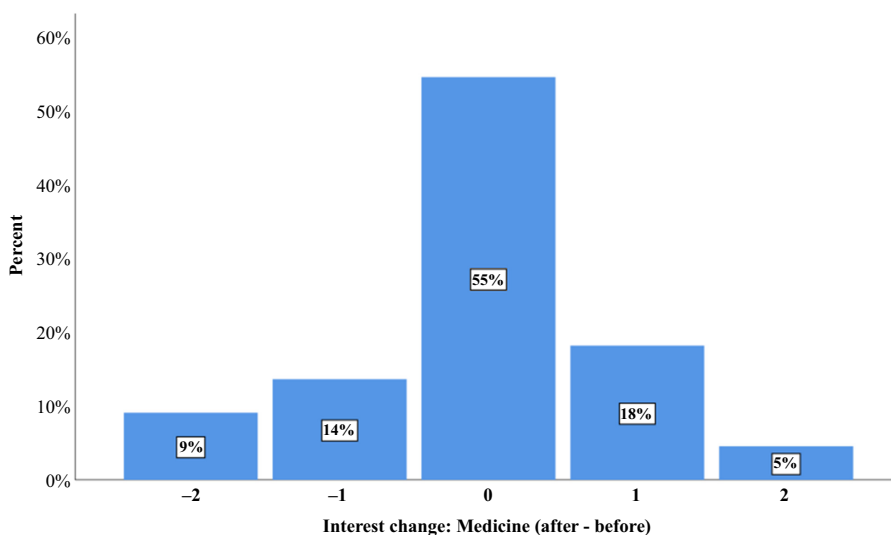


Figure 1. Change in participants' interest in medicine after intervention compared to before intervention

Figure 2.
Change in participants' interest in science after intervention compared to before intervention

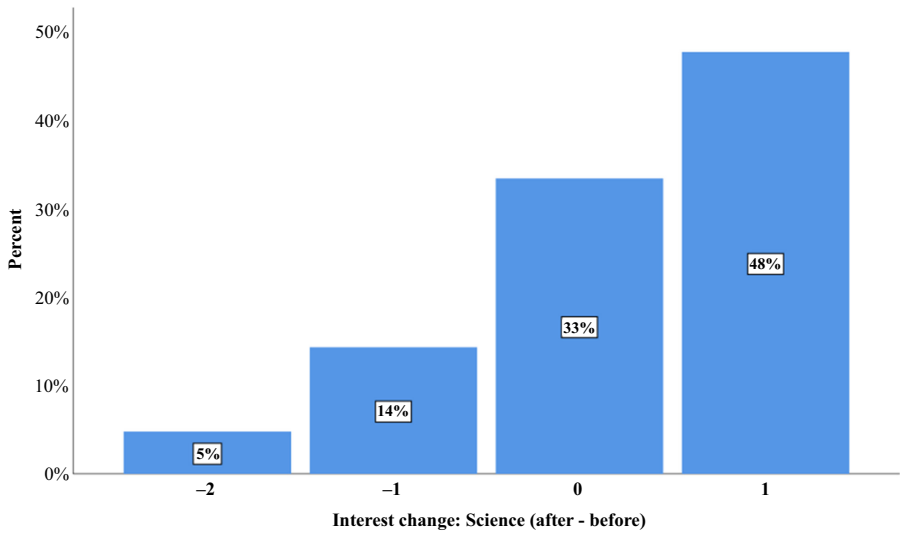
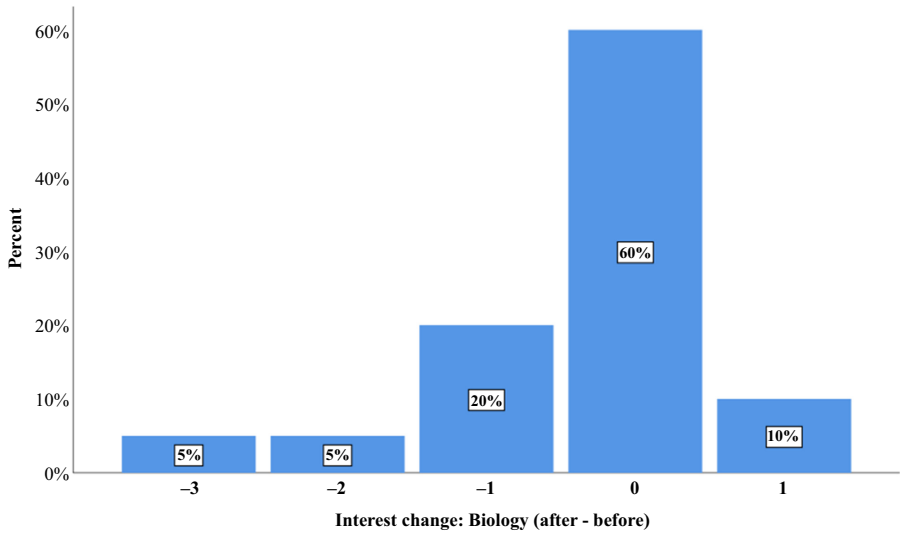


Figure 3.
Change in participants' interest in biology after intervention compared to before intervention



exposure to ultrasound. This fact may be reflective of the current deficiency in the availability of resources for advanced learning of the sciences for the DHH community.

In the end, the overall results were more neutral in report than expected. While the majority of the students did not have any increased interest in science, medicine, or biology after our intervention, we believe that these findings may need to be researched further with follow-up interviews to determine why the students were not as interested in these particular fields. There could be confounding societal or educational barriers that were not fully appreciated throughout this research study or the wrong post-survey questions could have been asked or misunderstood by the students in the analysis.

Additionally, we do recognize that there was a small proportion of students who reported an increase in their interest following our 3-course series, and this may be due to several factors. Based on feedback from the instructors who teach these DHH students, we learned that most of these students are visual learners. Thus, future studies may focus less on written presentations and more on visual presentations with more images and hands-on training. Students in these specific DHH classrooms are accustomed to more visual prompting in their learning, so adopting a curriculum that enhances student learning based on their learning abilities should be taken into consideration. Similarly, the student group size may have played a role in the ability of students to learn. We had a ratio of six students per instructor. This minimized the amount of probe time for each student to interact and engage with the ultrasound. Lastly, the length of the course may not have allowed all students to fully experience POCUS. It is possible that a year-long curriculum with additional clinical exposure may increase students' desires to enter STEM fields.

Ultimately, while the objective results of this study were equivocal at best, the results did not capture were the three individual students who were so captivated by the course, that they came in for specific emergency room (ER) shadow shifts with one of the ER attendings. Thus, we cannot define the success of this intervention based solely on the objective data alone, as the narrative of how certain students were positively influenced by our study definitely triumphed over any quantitative measurements recorded. From our experiences with this population, there appears to be a potential to reach this population in a more creative and engaging manner through POCUS.

The lack of statistical significance does not take away from the fact that there is an unmet need and desire for a bridge between this population and the medical community. Students from the DHH community are given significantly fewer opportunities for access to medical education. Additional barriers include the idea of "deaf stigma," which embodies the social ramifications of living in a society that labels deafness as an impairment (Mousley and Chaudoir, 2018). Framing deafness in this way simply requires a different means of communication, similar to how individuals who speak a different language may be perceived. It can be reasoned that the lack of change within these disciplines is likely due to inherent predispositions of a sense of un-belonging in medicine. Understandably, it would be difficult to reverse these perceptions in a short-term ultrasound course. Future large-scale studies are needed to better understand how we can impact students and learners in the DHH community. We hope our pilot study can provided a framework for future studies to build upon.

The need for more proactive and forward-thinking innovation in education and outreach for the disabled community, in particular the deaf and hard of hearing community, is warranted (Wells and Kommers, 2020; Meeks *et al.*, 2018). It is only through earlier pipeline opportunities and nontraditional pathways in education and outreach that we will start to see more representation of the disabled communities in the STEM and graduate degree fields (Wells and Kommers, 2020).

Limitations

There are several limitations in this study. First, this was a single-site study with a small sample size that was available only during the short course of the school year. Future larger-scale and longer longitudinal studies are needed to determine if our results are generalizable. Given the differing grade levels, the level of exposure that the students have to the sciences and future career options was likely more wide-ranging. Expansion of this pilot project to additional schools with different socioeconomic, cultural or political backgrounds will allow for better characterization of the data and generalizability. Additionally, we did not pursue any longitudinal studies to determine if any students pursued a career in STEM following our intervention.

From a more relatable perspective between the teacher and student, we recognize that none of the researchers involved are deaf or hard of hearing. We believe that having a deaf or hard of hearing physician or researcher present, could have enhanced the experience for the students. We did organize a short career counseling session with a radiologist who is deaf as aforementioned, but her time spent with the students was only brief.

References

- Bahner, D.P. and Royall, N.A. (2013), "Advanced ultrasound training for fourth-year medical students: a novel training program at the Ohio state University college of medicine", *Academic Medicine*, Vol. 88 No. 2, pp. 206-213.
- Bahner, D.P., Adkins, E.J., Hughes, D., Barrie, M., Boulger, C.T. and Royall, N.A. (2013), "Integrated medical school ultrasound: development of an ultrasound vertical curriculum", *Critical Ultrasound Journal*, Vol. 5 No. 1, p. 6.
- Bahner, D.P., Goldman, E., Way, D., Royall, N.A. and Liu, Y.T. (2014), "The state of ultrasound education in US medical schools: results of a national survey", *Academic Medicine*, Vol. 89 No. 12, pp. 1681-1686.
- Barnett, S. (2002), "Communication with deaf and hard-of-hearing people: a guide for medical education", *Academic Medicine*, Vol. 77 No. 7, pp. 694-700.
- Barnett, S., McKee, M., Smith, S.R. and Pearson, T.A. (2011), "Peer reviewed: deaf sign language users, health inequities, and public health: opportunity for social justice", *Preventing Chronic Disease*, Vol. 8 No. 2, pp. 1-6.
- Braun, D.C., Gormally, C. and Clark, M.D. (2017), "The Deaf Mentoring Survey: a community cultural wealth framework for measuring mentoring effectiveness with underrepresented students", *CBE—Life Sciences Education*, Vol. 16 No. 1, p. ar10.
- Claret, P.G., Bobbia, X., Le Roux, S., Bodin, Y., Roger, C., Perrin-Bayard, R., Muller, L. and de La Coussaye, J.E. (2016), "Point-of-care ultrasonography at the ED maximizes patient confidence in emergency physicians", *The American Journal of Emergency Medicine*, Vol. 34 No. 3, pp. 657-659.
- Denny, S.P., Minter, W.B., Fenning, R.T., Aggarwal, S., Lee, D.H., Raja, S.K., Raman, K.R., Farfel, A.O. and Patel, P.A. (2018), "Ultrasound curriculum taught by first-year medical students: a four-year experience in Tanzania", *World Journal of Emergency Medicine*, Vol. 9 No. 1, p. 33.
- Fox, J.C. (2017), *Clinical Emergency Radiology*, Cambridge University Press, Cambridge.
- Fox, J.C., Schlang, J.R., Maldonado, G., Lotfipour, S. and Clayman, R.V. (2014), "Proactive medicine: the 'UCI 30,' an ultrasound-based clinical initiative from the University of California", *Irvine Academic Medicine*, Vol. 89 No. 7, pp. 984-989.
- Garberoglio, C.L., Dickson, D., Cawthon, S. and Bond, M. (2015), "Leveling the playing field? Communication technology as a predictor of future attainments for deaf young adults", *Disability Studies Quarterly*, Vol. 35 No. 4, pp. 1-20.
- Gregerman, S.R., Lerner, J.S., Von Hippel, W., Jonides, J. and Nagda, B.A. (1998), "Undergraduate student-faculty research partnerships affect student retention", *The Review of Higher Education*, Vol. 22 No. 1, pp. 55-72.
- Hathaway, R.S., Nagda, B.A. and Gregerman, S.R. (2002), "The relationship of undergraduate research participation to graduate and professional education pursuit: an empirical study", *Journal of College Student Development*, Vol. 43 No. 5, pp. 614-631.
- Hoppmann, R.A., Rao, V.V., Poston, M.B., Howe, D.B., Hunt, P.S., Fowler, S.D., Paulman, L.E., Wells, J.R., Richeson, N.A., Catalana, P.V. and Thomas, L.K. (2011), "An integrated ultrasound curriculum (iUSC) for medical students: 4-year experience", *Critical Ultrasound Journal*, Vol. 3 No. 1, pp. 1-12.
- How Are the Terms Deaf, Deafened, Hard of Hearing, and Hearing Impaired Typically Used?*, available at: <https://www.washington.edu/doi/how-are-terms-deaf-deafened-hard-hearing-and-hearing-impaired-typically-used> (accessed 30 April 2019).

- Howard, Z.D., Noble, V.E., Marill, K.A., Sajed, D., Rodrigues, M., Bertuzzi, B. and Liteplo, A.S. (2014), "Bedside ultrasound maximizes patient satisfaction", *The Journal of Emergency Medicine*, Vol. 46 No. 1, pp. 46-53.
- Kwon, A.S., Lahham, S. and Fox, J.C. (2019), "Can an 8th grade student learn point of care ultrasound?", *World Journal of Emergency Medicine*, Vol. 10 No. 2, p. 109.
- Lee, J.B., Tse, C., Keown, T., Louthan, M., Gabriel, C., Anshus, A., Hasjim, B., Lee, K., Kim, E., Yu, L. and Yu, A. (2017), "Evaluation of a point of care ultrasound curriculum for Indonesian physicians taught by first-year medical students", *World Journal of Emergency Medicine*, Vol. 8 No. 4, p. 281.
- McKee, M.M., Smith, S., Barnett, S. and Pearson, T.A. (2013), "Commentary: What are the benefits of training deaf and hard-of-hearing doctors?", *Academic Medicine: Journal of the Association of American Medical Colleges*, Vol. 88 No. 2, p. 158.
- Meeks, L.M., Engelman, A., Booth, A. and Argenyi, M. (2018), "Deaf and Hard-of-Hearing learners in emergency medicine", *Western Journal of Emergency Medicine*, Vol. 19 No. 6, p. 1014.
- Miner, B., Purdy, A., Curtis, L., Simonson, K., Shumway, C., Baker, J., Vaughan, J., Percival, K., Sanchez, O., Lahham, S. and Joseph, L. (2015), "Feasibility study of first-year medical students identifying cardiac anatomy using ultrasound in rural Panama", *World Journal of Emergency Medicine*, Vol. 6 No. 3, p. 191.
- Moreland, C.J., Latimore, D., Sen, A., Arato, N. and Zazove, P. (2013), "Deafness among physicians and trainees: a national survey", *Academic Medicine*, Vol. 88 No. 2, pp. 224-232.
- Mousley, V.L. and Chaudoir, S.R. (2018), "Deaf stigma: links between stigma and well-being among deaf emerging adults", *The Journal of Deaf Studies and Deaf Education*, Vol. 23 No. 4, pp. 341-350.
- Rao, S., van Holsbeeck, L., Musial, J.L., Parker, A., Bouffard, J.A., Bridge, P., Jackson, M. and Dulchavsky, S.A. (2008), "A pilot study of comprehensive ultrasound education at the Wayne State University School of Medicine: a pioneer year review", *Journal of Ultrasound in Medicine*, Vol. 27 No. 5, pp. 745-749.
- Scheier, D.B. (2009), "Barriers to health care for people with hearing loss: a review of the literature", *Journal of the New York State Nurses Association*, Vol. 40 No. 1, p. 4.
- Steinberg, A.G., Barnett, S., Meador, H.E., Wiggins, E.A. and Zazove, P. (2006), "Health care system accessibility", *Journal of General Internal Medicine*, Vol. 21 No. 3, p. 260.
- Wells, R. and Kommers, S. (2020), "Graduate and professional education for students with disabilities: examining access to STEM, legal, and health fields in the United States", *International Journal of Disability, Development and Education*, Vol. 67 No. 6, pp. 1-15 .

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