Journal of the American Pharmacists Association xxx (2020) 1–6

Contents lists available at ScienceDirect

Journal of the American Pharmacists Association

journal homepage: www.japha.org

RESEARCH

Using an OSCE to assess the potential for assistive technology to enhance communication between student pharmacists and simulated patients who are deaf/hard of hearing

Michelle L. Blakely*, Kristyn D. McKnight, Rebecca A. Darling, Eric J. Moody

ARTICLE INFO

Article history:
Received 30 April 2020
Accepted 17 August 2020

ABSTRACT

Objectives: To evaluate the usefulness of assistive technology in health care interactions between student pharmacists and simulated patients who are deaf/hard of hearing and to assess changes in confidence and comfort levels (among both groups) when using assistive technology.

Methods: Forty-nine second-year student pharmacists were enrolled in a pharmacy communication laboratory course and 8 undergraduate students were recruited during Fall 2019. The first communication laboratory interaction consisted of student pharmacists using their normal mode of communication with role-played patients who are deaf/hard of hearing to establish baseline measures; a pretest survey was administered to each participant at the conclusion of this 10-minute laboratory interaction. In the second laboratory interaction, student pharmacists used the app to assist in communicating with the simulated patients who are deaf/hard of hearing. Posttests were administered at the conclusion of this laboratory interaction.

Results: Most student pharmacists and simulated patients who are deaf/hard of hearing reported feeling able to effectively communicate their needs to the other individual in their dyad (pharmacist or patient) during their health care interactions. Using an iPad (Apple Inc) app to communicate significantly increased student pharmacist and simulated patient comfort with health care communication from preintervention to postintervention.

Conclusion: The use of assistive technology in simulated communication laboratory interactions can enhance student pharmacist comfort in health care interactions with patients who are deaf/hard of hearing.

Background

Effective communication is a crucial component of successful health care interactions. If a pharmacist is not effective in conveying relevant and important medication or treatment information to a patient, negative health consequences may result. Conversely, negative outcomes can result if a patient does not understand the instructions/information provided by the pharmacist. Pharmacist-patient communication can be significantly challenging at times, and can be exacerbated if the patient is deaf/hard of hearing.[1] Researchers have observed that patients who are deaf/hard of hearing struggle when seeking health care services owing to severe communication barriers.[2-6] In addition, studies have consistently shown that pharmacists often feel uncomfortable/unprepared to understand the unique needs of, or to communicate with, patients who are deaf/hard of hearing.[4] Hence, communication is perhaps the most significant obstacle to the delivery of quality health care to those who are deaf/hard of hearing.[7,8]

The National Center for Health Statistics reports that approximately 37.6 million American adults have some level of hearing loss or impairment.[9] The World Health Organization estimates that approximately 466 million people worldwide have disabling hearing loss, and approximately 34 million of these individuals are children.[10] Disabling hearing loss is defined as hearing loss greater than 40 decibels (dB) in the

Disclosure: The authors declare no relevant conflicts of interest or financial relationships.

Funding: Wyoming Institute for Disabilities (WIND; 001).

* **Correspondence:** Michelle L. Blakely, PhD, MEd, NCC, Assistant Professor of Social and Administrative Pharmacy, University of Wyoming School of Pharmacy, 1000 E. University Ave., Dept. 3375, Laramie, WY 82071.

E-mail address: michelle.blakely@uwyo.edu (M.L. Blakely).

https://doi.org/10.1016/j.japh.2020.08.031
1544-3191/

Key Points

Background:

- Effective communication is a crucial component of successful health care interactions.
- Pharmacists often feel unprepared to understand the unique needs of, or to effectively communicate with, patients who are deaf/hard of hearing.
- Inadequate or ineffective communication between pharmacists and patients who are deaf/hard of hearing impedes the establishment of rapport.

Findings:

- Assistive technology was found to be effective at significantly increasing comfort levels for student pharmacists during health care interactions.
- Student pharmacists felt better understood when using assistive technology to communicate with simulated patients who are deaf/hard of hearing.
- Findings from this project can help faculty at colleges/schools of pharmacy identify ways to use assistive technology to enhance student pharmacist skills and comfort when communicating with patients who are deaf/hard of hearing.

better hearing ear for adults, and a hearing loss greater than 30 dB in the better hearing ear for children.[10] An individual who is not able to hear at normal levels (defined as hearing thresholds of 25 dB or better in both ears) is considered to have hearing loss.[10] Hearing loss can affect 1 or both ears, and be classified as mild, moderate, severe, or profound. The term "hard of hearing" refers to individuals with hearing loss that ranges from mild to severe.[10] Individuals who are hard of hearing usually communicate through spoken language, and often benefit from the use of hearing aids and other assistive devices.[10] Individuals who are deaf have profound hearing loss with limited or no hearing ability. These individuals often use sign language to communicate.

Inadequate or ineffective communication between pharmacists and patients who are deaf/hard of hearing impedes the establishment of rapport.[11] Rapport can be considered the development of trust, respect, and understanding between 2 individuals, forming an essential component of human communication.[12] In the absence of rapport, a strained pharmacist-patient relationship can result in widening health care disparities,[11] lack of knowledge of important health issues, and possibly an avoidance of care.[1] Hence, clear and concise communication between pharmacists and patients who are deaf/hard of hearing is a vital component in the delivery of effective health care.

Traditionally, most school/college of pharmacy programs provide student pharmacists with only a brief introduction to the deaf/hard of hearing population.[13] Didactic content focusing on considerations for effective communication and relationship building is the general approach.[13] However, this approach fails to provide comprehensive content necessary for student mastery of those skills/techniques that prove effective when communicating with this unique demographic.[13] As such, student pharmacists may feel unprepared and even uncomfortable and not confident during health care interactions involving patients who are deaf/hard of hearing.

Objectives

The objectives of this project were to (1) evaluate the usefulness of assistive technology (an iPad [Apple Inc] communication app) for health care interactions between student pharmacists and simulated patients who are deaf/hard of hearing, and (2) assess changes in confidence and comfort levels for the project participants when using assistive technology to communicate.

Methods

During Fall semester 2019, 49 second-year student pharmacists (P2s) at the University of Wyoming School of Pharmacy were enrolled in the "PHCY 6245 Patient/Professional Interactions" course as part of their required core PharmD curricula. This communication course had a required laboratory component that used Objective Structured Clinical Examinations (OSCEs) to evaluate student pharmacists' communication skills with simulated patients. The simulated patients for this project were role-played by undergraduate students.

Study procedures

In August 2019, a recruitment flyer was sent to the University of Wyoming Drama/Theater Department for distribution to currently enrolled drama/theater students. To attract undergraduate students for study participation, a small financial incentive was offered ($20 per hour for a maximum of 6 hours). Interested students were instructed to contact the principal investigator of the study via e-mail to schedule a time to meet and discuss the project. During this meeting, the prospective participants were briefed on the study and its purpose, and asked to give written consent to participate. A total of 8 undergraduate students consented to participate as standardized patients.

These undergraduate students were provided a standardized patient script for simulating a patient who is deaf/hard of hearing. Before project implementation, each student attended a 1- hour training session to develop familiarity with the study, the communication laboratory interactions, and the patient roles and to ask the course instructor questions about the laboratory interactions and the process involved. This training specifically instructed the simulated patients to rely on the assistive technology as the primary means to communicate rather than using their auditory or verbal abilities. All activities for this project were reviewed and approved as exempt by the University of Wyoming Institutional Review Board.

At the beginning of each communication laboratory interaction, the student pharmacists were provided condensed versions of the patient role-playing scripts that contained only basic patient information. This was done to simulate a more realistic situation that they may encounter in the pharmacy. A

few days after the first (baseline) laboratory interaction and before the communication laboratory interaction that used the assistive technology, the student pharmacists received 1-hour in-class iPad app training and supervised practice with the app from the Wyoming Assistive Technology Resources (WATR) staff. Microsoft's Translator app (Microsoft Corporation) was chosen as the intervention app because it offered 3 user benefits: (1) it was available for use on both Apple and Android platforms, (2) it was free of charge to download and to use, and (3) it was able to translate multiple forms of input into written (visual) and spoken (verbal) communication.

Project implementation

Both communication laboratory interactions were conducted in October 2019. The communication laboratory interaction setting consisted of 6 small counseling rooms, which allowed 6 sets of dyads (1 student pharmacist and 1 simulated patient) to complete the OSCEs for each scheduled 10-minute time block. The student pharmacists arrived approximately 5 minutes before their scheduled OSCEs to receive pertinent patient scenario information and to be assigned a counseling room. Inside the counseling room, the student pharmacists had access to Medline informational printouts of the medication to be discussed during the OSCE and an empty medication bottle to use as a visual aid.

The first OSCE laboratory interaction involved the usual (baseline) mode of communicating for student pharmacists with a standardized patient (an undergraduate student). In this laboratory interaction, the standardized patients were picking up a new prescription (lisinopril, metformin, warfarin, or esomeprazole), and they expressed concerns regarding adverse effects, (not understanding) why they needed the medication, or how to fit taking a new medication into their daily schedule. The communication app was not used during this laboratory interaction. The pretest survey was administered at the conclusion of the 10-minute health care interaction to all participants.

The second OSCE laboratory interaction involved the use of the communication app, which was preinstalled on the iPads that were borrowed from the WATR office. For this laboratory interaction, each counseling room contained the Medline informational printout of the medication to be discussed during the OSCE, an empty medication bottle to use as a visual aid, and the iPad with the Microsoft Translator app preinstalled. Each student pharmacist was allotted 10 minutes to have a health care conversation using the iPad app with the simulated patient who is deaf/hard of hearing. These health care conversations were for a refill prescription (atenolol, fluoxetine, rosuvastatin, hydrochlorothiazide, or alendronate). The concerns discussed for these medications included not adhering to the prescribed medication regimen (nonadherence); experiencing adverse effects; taking medication in a way that differed from how it was prescribed (i.e., taking more at 1 time [overdosage], or taking the medication less often than prescribed [only when symptoms were present or when the patient remembered to take it]); or not understanding why the medication was needed. Posttests were administered at the conclusion of this laboratory interaction to all participants. All patient cases used in this project were standardized, comparable, and involved 3 common medication adherence issues: (1) adverse effects, (2) questions/concerns about how to take the medication properly, and (3) not understanding why the medication was needed.

Study instrument

The study questionnaire contained 9 items. Five items used a 5-point Likert scale (where a value of 1 indicated "not at all," and a value of 5 indicated "extremely" comfortable or confident) to ask the participants about their comfort and confidence levels when communicating in the OSCE health care interactions, the ease with which the communication occurred, and how understood they felt when communicating. The participants were also asked about their perception of how confident the other individual in the dyad (patient or pharmacist) appeared during their 10-minute health care discussion.

The student pharmacists were also asked about the frequency with which they anticipate interacting with patients who are deaf/hard of hearing at their future practice sites. The simulated patients were asked a comparable question regarding how frequently they anticipate interacting with health professionals in the future. The response options ranged from 1 (never) to 5 (all health care visits). All participants were also asked (yes or no) if they felt that they had been able to effectively communicate with the other individual in their dyad (patient or pharmacist).

Before use, the study questionnaire was sent via e-mail to the WATR staff and to 3 pharmacy faculty members who are clinical pharmacists (2 of whom work in community practice sites) for pilot testing and item feedback. No major revisions were required, but suggestions were made regarding ways to improve clarity. All comments and suggestions were successfully incorporated into the final version of the survey.

Analysis plan

All statistical analyses were performed using SPSS for Macintosh version 26 (IBM Corp).[14] The Wilcoxon signed-rank test is the nonparametric test equivalent to the dependent *t* test.[15] It is used to compare 2 sets of scores obtained from the same groups of participants. It does not assume normality in the data; therefore, it can be used when this assumption is violated.[15] The distribution for the current data set failed this assumption; therefore, the Wilcoxon signed-rank test was determined to be the appropriate statistical test.

A paired samples sign test (often referred to as the sign test) is used to determine whether there is a median difference between paired/matched observations.[16] It is considered an alternative to the Wilcoxon signed-rank test when the distribution of differences between paired observations is neither normal nor symmetrical.[16] Preliminary analyses determined that the differences between paired observations in the current data set met this as well as all other assumptions required to use the sign test.

Results

Approximately half of the student pharmacists felt comfortable or extremely comfortable when communicating with the simulated patients who are deaf/hard of hearing at preintervention (47%); the number of student pharmacists

Table 1
Student pharmacist perspectives of using an iPad app to communicate with simulated patients who are deaf/hard of hearing

Question	Preintervention, mean ± SD	Postintervention, mean ± SD	*Z*	*P*-value (2-tailed)
How comfortable are you in communicating with the patient?	3.20 ± 1.080	3.92 ± 0.710	−3.127	0.002[a]
How confident were you in communicating with the patient?	3.37 ± 0.906	3.52 ± 0.618	−1.175	0.240
How understood did you feel when communicating with the patient?	3.29 ± 0.957	4.08 ± 0.577	−3.808	0.000[b]
How confident did the patient appear in communicating with you?	3.88 ± 0.832	3.94 ± 0.755	−0.312	0.755

Note: Wilcoxon signed-rank test.
[a] $P < 0.05$.
[b] $P < 0.001$.

who felt comfortable or extremely comfortable when using the app to communicate increased to more than three-quarters at postintervention (80%). Approximately half of the student pharmacists felt confident or extremely confident when communicating with the simulated patients who are deaf/hard of hearing at preintervention (51%), with that percentage increasing slightly at postintervention (54%).

The student pharmacists were asked questions pertaining to their health care interactions with the simulated patients who are deaf/hard of hearing. Table 1 provides the results of the Wilcoxon signed-rank test, which indicate that the use of the iPad app to communicate with patients who are deaf/hard of hearing significantly increased student pharmacist comfort in communicating with them from preintervention to postintervention ($Z = -3.127$, $P = 0.002$), and had a small effect size ($r = -0.32$).[17] In addition, the student pharmacists felt better understood when communicating with the simulated patient who is deaf/hard of hearing postintervention compared with preintervention ($Z = -3.808$, $P < 0.001$). This finding also had a small effect size ($r = -0.26$).[17] Table 2 provides the results of the sign test analysis, which indicated that the 49 student pharmacists who used the iPad app to communicate found it significantly easier to communicate with the simulated patients who are deaf/hard of hearing from preintervention to postintervention ($P = 0.000$).

The role-played simulated patients were also asked about using the app to communicate with the pharmacist. Table 3 provides the results from the sign test analyses, which indicated that the use of an iPad app to communicate significantly increased patient comfort in communicating with pharmacists from preintervention to postintervention ($P = 0.012$).

The Wilcoxon signed-rank test indicated that the use of an iPad app to communicate did not significantly increase pharmacist confidence in communicating with patients who are deaf/hard of hearing (from the patients' perspective) from preintervention to postintervention ($Z = -0.828$, $P = 0.407$) (Table 4).

All study participants were asked (yes or no) if they felt that they had been able to effectively communicate with the other individual in their dyad (patient or pharmacist). Most of the simulated patients who are deaf/hard of hearing reported feeling that they were able to effectively communicate their needs to the pharmacist during their health care interaction at both preintervention (63%) and postintervention (80%). A similar finding was also observed for student pharmacists. They indicated that they were able to effectively communicate with the patient who is deaf/hard of hearing at both preintervention (65%) and postintervention (98%).

More than half of the student pharmacists (58%) anticipated interacting with patients who are deaf/hard of hearing during some future visits, followed by most visits (34%), at preintervention. At postintervention, the student pharmacists anticipated that they would interact with patients who are deaf/hard of hearing during most future visits (37%), and some visits (35%). In addition, at postintervention, 6 student pharmacists anticipated that they would interact with patients who are deaf/hard of hearing during all future health care visits (12%).

Discussion

This is one of the first known studies to evaluate the use of assistive technology in communication laboratory OSCE health care interactions between student pharmacists and simulated patients who are deaf/hard of hearing, and the first known study of its kind to be conducted in the United States. The results of this study have demonstrated that assistive technology was effective at significantly increasing student pharmacist comfort in communicating with simulated patients who are deaf/hard of hearing, while also increasing the comfort of a simulated patient who is deaf/hard of hearing in communicating with student pharmacists.

Unlike Motlhabi et al.[18] and Chininthorn et al.,[19] whose pharmacist and patient participants found a communication app to be easy to use, the results of the current study were not statistically significant for the app's "ease of use." This dissimilarity could be attributed to the Internet connection or the app used in this project. For example, the Internet connection in the building was not consistent for the entirety of the communication laboratory interactions. Several study

Table 2
Student pharmacist perspectives regarding ease of use of an iPad app to communicate with simulated patients who are deaf/hard of hearing

How easy was it to communicate with the patient?	N	Mean	Median	SD	*P*-value (2-tailed)
Preintervention	49	3.45	4.00	0.937	0.000[a]
Postintervention	49	4.19	4.00	0.607	

Note: Sign test.
[a] $P < 0.000$.

Table 3
Simulated patient perspectives of using an iPad app to communicate with student pharmacists

How easy was it to communicate with the pharmacist?	N	Mean	Median	SD	*P*-value (2-tailed)
Preintervention	49	3.81	4.00	1.179	0.123
Postintervention	49	4.12	4.00	1.013	
How comfortable were you in communicating with the pharmacist?	—	—	—	—	—
Preintervention	49	3.65	4.00	1.176	0.012[a]
Postintervention	49	4.33	4.00	0.774	
How confident were you in communicating with the pharmacist?	—	—	—	—	—
Preintervention	49	3.52	4.00	1.111	0.082
Postintervention	49	4.06	4.00	0.827	
How understood did you feel when communicating with the pharmacist?	—	—	—	—	—
Preintervention	49	3.48	4.00	1.271	0.055
Postintervention	49	4.06	4.00	0.944	

Note: Sign test.
[a] $P < 0.05$.

participants reported connectivity issues with the iPads, and this could have contributed to the perception that the app was not easy to use. In addition, some participants expressed concern that the app required the user to speak continuously without pausing, or the app would stop recording their spoken words and begin to prematurely translate the message. This premature translation could result in patients missing vital information regarding their medications.

Using the iPad app to communicate did not significantly increase the student pharmacists' confidence when communicating with the simulated patients who are deaf/hard of hearing. The simulated patients reported similar observations regarding the student pharmacists' lack of confidence during their health care interactions. These results may be due to the limited experience that P2s have in counseling and patient health care interactions. Ferguson and Shan[20] found that most pharmacists (69%) expect to have 1 to 5 interactions with patients who are deaf/hard of hearing per month. The results of the current study were similar to these findings because the student pharmacists indicated that they anticipate interacting with patients who are deaf/hard of hearing during some or most visits (72%). These results are encouraging because pharmacists are readily available and more accessible than other providers for patients who are deaf/hard of hearing seeking health care information. However, for pharmacists to be effective in their health care delivery, they must also feel confident in their abilities to work with patients who are deaf/hard of hearing.

Ferguson and Shan[20] also asked pharmacists about their comfort level when working with patients who are deaf/hard of hearing. Their results revealed that a third of the pharmacists (30%) were very to somewhat comfortable working with patients who are deaf/hard of hearing, whereas a few (10%) reported feeling very uncomfortable. The results of the current project were significant for student pharmacist comfort when communicating with simulated patients who are deaf/hard of hearing. Student pharmacist responses at baseline/preintervention had a mean of 3.65 out of 5, and had increased to 4.33 out of 5 at postintervention. This project examined the use of an intervention (an iPad app) and asked about comfort in relation to baseline (preintervention) and after using the app at postintervention. For all the OSCE health care interactions, the student pharmacists seemed to have some level of comfort when working with the simulated patients who are deaf/hard of hearing. This may be explained by previous experiences working with patients who are deaf/hard of hearing. Most student pharmacists have held previous work positions before entering pharmacy school that may have provided opportunities to interact with individuals who are deaf/hard of hearing. Familiarity with this patient population could have added to the student pharmacists' reported comfort levels. Another possible explanation is that today's tech-savvy students are familiar with developing technologies and are therefore comfortable when using technology to interact with patients.

Limitations

This study has several limitations. First, it used role-played simulated patients who were not deaf/hard of hearing. Therefore, these results may not be generalizable to the deaf/hard of hearing population. Second, the OSCEs were conducted in an artificial, controlled setting; therefore, the results may not be generalizable to real-world pharmacy practice sites. This study only included student pharmacists at 1 school of pharmacy, and as such may limit the generalizability of the results to other student pharmacists/pharmacists. Finally, only 1 app, Microsoft Translator, was used in this project, reducing the generalizability of these results to other apps and other types of assistive technology.

Future research endeavors should seek to examine the applicability of assistive technology in the real world with practicing pharmacists and actual patients who are deaf/hard of hearing. Identifying the barriers and facilitators to using assistive technology at various practice sites should be explored as well. Issues such as consistent/reliable Internet

Table 4
Simulated patient perspectives of student pharmacist confidence when communicating with patients who are deaf/hard of hearing

Question	Preintervention, mean ± SD	Postintervention, mean ± SD	*Z*	*P*-value (2-tailed)
How confident did the pharmacist appear in communicating with you?	3.65 ± 1.041	3.84 ± 0.965	−0.828	0.407

Note: Wilcoxon signed-rank test.

connectivity may have a direct and negative impact on practice sites in their efforts to use assistive technology, especially if the technology requires a constant Internet connection for functionality. Furthermore, it will be important to conduct research that explores the use of different types of assistive technology to help identify the best options for patients who are deaf/hard of hearing, pharmacists, and practice sites.

Conclusion

The use of assistive technology in simulated communication laboratory interactions can enhance student pharmacist comfort in health care interactions with patients who are deaf/hard of hearing. The findings from this project can help faculty at colleges/schools of pharmacy identify ways to integrate assistive technology into their courses/laboratory interactions to enhance student pharmacist skills and comfort when communicating with patients who are deaf/hard of hearing. Increasing pharmacists' skills, confidence, and comfort when using assistive technology would improve rapport with patients who are deaf/hard of hearing and increase their knowledge of health care, promote safe medication use, and optimize patient outcomes. Future research should be conducted to identify best practices related to using assistive technology to improve health care communication between pharmacists and patients who are deaf/hard of hearing.

Acknowledgments

The authors extend their sincere gratitude to the Wyoming Institute for Disabilities (WIND) and its staff for the financial support provided. In particular, we owe thanks to WIND Executive Director Ms Sandy Root-Elledge for her encouragement, support, and expertise. In addition, the authors would like to thank the WATR staff for their time and expertise. WATR supplied the iPads and communication app used in this project. Special thanks to Mr Ryan Rausch and Ms Terri Wofford, who were instrumental in training the student pharmacists to use the communication app before project implementation.

References

1. Iezzoni LI, O'Day BL, Killeen M, Harker H. Communicating about health care: observations from persons who are deaf or hard of hearing. *Ann Intern Med*. 2004;140(5):356–362.
2. Hoang L, Lahousse SF, Nakaji MC, Sadler GR. Assessing deaf cultural competency of physicians and medical students. *J Cancer Educ*. 2011;26(1):175–182.
3. Kuenburg A, Fellinger P, Fellinger J. Health care access among deaf people. *J Deaf Stud Deaf Educ*. 2016;21(1):1–10.
4. Ferguson M, Liu M. Communication needs of patients with altered hearing ability: informing pharmacists' patient care services through focus groups. *J Am Pharm Assoc (2003)*. 2015;55(2):153–160.
5. Hyoguchi N, Kobayashi D, Kubota T, Shimazoe T. Effects on deaf patients of medication education by pharmacists. *J Deaf Stud Deaf Educ*. 2016;21(4):416–421.
6. Smith SR, Samar VJ. Dimensions of deaf/hard-of-hearing and hearing adolescents' health literacy and health knowledge. *J Health Commun*. 2016;21(Suppl 2):141–154.
7. Scheier DB. Barriers to health care for people with hearing loss: a review of the literature. *J N Y State Nurs Assoc*. 2009;40(1):4–10.
8. Ralston E, Zazove P, Gorenflo DW. Physicians' attitudes and beliefs about deaf patients. *J Am Board Fam Pract*. 1996;9(3):167–173.
9. Blackwell DL, Lucas JW, Clarke TC. Summary health statistics for U.S. adults: national health interview survey, 2012. *Vital Health Stat 10*. 2014;(260):1–161.
10. World Health Organization. Deafness and hearing loss. Available at: https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss. Accessed March 24, 2020.
11. Barnett S. Communication with deaf and hard-of-hearing people: a guide for medical education. *Acad Med*. 2002;77(7):694–700.
12. Rickles NM, Wertheimer AI, Smith MC. *Social and Behavioral Aspects of Pharmaceutical Care. 2nd ed*. Sudbury. MA: Jones and Bartlett Publishers; 2010.
13. Blakely ML, Salvo MC. Improving communication between healthcare professionals and deaf and hard of hearing patients. *Res Social Admin Pharm*. 2019;15(9):1193–1194.
14. IBM Corp. *Released 2019. SPSS Statistics for Macintosh*, Version 26.0. Armonk, NY: IBM Corp.
15. Statistics How To. Wilcoxon signed rank test: definition, how to run. Available at: https://www.statisticshowto.datasciencecentral.com/wilcoxon-signed-rank-test/. Accessed March 30, 2020.
16. Statistics How To. Sign test: step by step calculation. Available at: https://www.statisticshowto.datasciencecentral.com/sign-test/. Accessed March 30, 2020.
17. Cohen J. *Statistical Power Analysis for the Behavioral Sciences. 2nd ed*. New York, NY: Lawrence Erlbaum Associates; 1988.
18. Motlhabi MB, Tucker WD, Parker MB, Glaser M. Improving usability and correctness of a mobile tool to help a deaf person with pharmaceutical instruction. In: *4th Annual Symposium on Computing for Development (ACM DEV-4)*. New York, NY: Association for Computing Machinery; 2013:1–10.
19. Chininthorn P, Glaser M, Freudenthal A, Tucker W. Mobile communication tools for a South African deaf patient in a pharmacy context. In: Cummingham P, Cummingham C, eds. *IST-Africa 2012 Conference Proceedings*. Dublin, Ireland: International Information Management Corporation; 2012:1–8.
20. Ferguson MC, Shan L. Survey evaluation of pharmacy practice involving deaf patients. *J Pharm Pract*. 2016;29(5):461–466.

Michelle L. Blakely, PhD, MEd, NCC, Assistant Professor of Social and Administrative Pharmacy, University of Wyoming School of Pharmacy, Laramie, WY

Kristyn D. McKnight, Student Pharmacist, University of Wyoming School of Pharmacy, Laramie, WY

Rebecca A. Darling, Student Pharmacist, University of Wyoming School of Pharmacy, Laramie, WY

Eric J. Moody, PhD, Research Professor and Director of Research and Evaluation, Wyoming Institute for Disabilities, University of Wyoming, Laramie, WY