Canadian Audiologist
The Official Publication of the Canadian Academy of Audiology

Patient-Provider Healthcare Communication in the Hospital Setting

Published February 25th, 2026

Carol A Silverman, PhD, MPH
Theresa V Chan-Leveno, MD
Elizabeth Frerich, MSN, FNP-C
Joseph J Montano, EdD, CCC-A
Richel Ruivivar-Khan, FNP-BC
Alan K Silverman, M.D.
Richard Einhorn

Abstract

Effective communication in hospital settings remains challenging for patients with hearing loss and contributes to hearing impairment's adverse effects on health and related health outcomes. The purpose of this quality improvement study was to proactively address communication barriers imposed by hearing loss in a hospital setting using Wi-Fi-based wireless smartphone technology during patient-provider face-to-face encounters. Over ten weeks, smartphones were configured as wireless assistive listening systems and deployed in two examination rooms in the otolaryngology head and neck clinic of an urban hospital serving a community with a large Hispanic/Latino population. Forty-four patients completed a brief questionnaire surveying their opinions and attitudes during patient-provider interactions. The vast majority favorably judged the technology to be efficacious in enhancing provider-patient communicative interactions and easy to use. The beneficial effects of the smartphone technology were observed in both Spanish- and English-

speaking patients. Future research is needed to evaluate smartphone-based assistive listening technology interventions from the patient perspective over a long-term period in various settings within the hospital and from the healthcare provider's perspective.

Introduction

Effective communication in hospital settings for patients with hearing loss remains challenging. The prevalence of hearing loss, the seriousness of the condition, and its impact on effective communication often are underestimated and misunderstood, especially when the condition is untreated. Solutions enabling effective communication between healthcare providers and patients with hearing loss in a hospital setting often are underutilized and inefficient.

Hospital settings typically have high ambient noise levels that often exceed the limits recommended by the World Health Organization (WHO).[1,2] Background noise in hospital settings further exacerbates communication problems due to hearing impairment.[3]

One of the most common difficult listening situations for patients in healthcare settings is patient-provider communication when the healthcare provider's back is turned towards the patient.[4] This frequently occurs in part because of electronic medical record when healthcare providers input patient information during the consultation. The risk of low patient activation levels (a measure of the patient's ability to be involved in the healthcare process) is significantly increased among older adult patients who report either "a lot of trouble" hearing or even "a little trouble" when compared with older adult patients who report "no trouble."[5] The odds of favorable ratings of physician-patient communication and healthcare experiences in non-institutionalized adults with self-reported hearing loss are significantly lower than in adults without such loss[6].

Poor patient-healthcare provider communication resulting from hearing loss contributes to adverse health and related health outcomes, including increased patient dissatisfaction with healthcare and increased patient perception of unmet healthcare needs. These perceptions ultimately can lead to further degradation of health status.[7] Hearing loss can increase the frequency of misperceptions and reduce the ability to participate in discussions involving unfamiliar health jargon. It can increase frustration, and the lack of knowledge of effective communication strategies with patients with hearing loss can compromise the effectiveness of healthcare provider communication.[6] Patients may withhold information regarding their hearing loss from the healthcare provider because of concerns about possible provider biases relating to ageism, disability, and vanity.[8]

A recent study found that clinicians feel smartphones are efficacious in enhancing healthcare communication and patient safety.[9] Personal, private wireless communication systems allow the healthcare provider to move around freely, for example, during a physical examination. Therefore, the purpose of this pilot quality improvement project was to investigate the impact of smartphone technology during clinical examinations on patient-provider communication, patient activation level, and usability of the technology in an otolaryngology head and neck clinic of an urban hospital serving a community with a large Hispanic/Latino population.

Methods

Healthcare providers of clinical otolaryngologic services in pre-determined examination rooms (two nurse practitioners, an otolaryngologist, and five otolaryngology residents) used a smartphone-based wireless assistive listening system during patient-provider face-to-face communication. This system incorporated a software application initially developed for classrooms, meeting rooms, and lecture halls. Healthcare providers explained the operation of the devices to patients. They asked patients who used the devices if they would anonymously complete, after their clinic visit, a brief survey on their perceptions regarding its efficacy. The intervention was instituted over ten weeks.

Intervention

Separate local Wi-Fi networks were installed, with the approval of the information technology department, in two examination rooms in the otolaryngology head and neck clinic of an urban hospital serving a community with a large Hispanic/Latino population. Each examination room's Wi-Fi network consisted of a Wi-Fi access point (4ipNet EAP767, Taipei, Taiwan) connected via ethernet CAT 5e cable to a standard router (Netgear N300, San Jose, CA). Each room's Wi-Fi network was password-protected to ensure privacy.

Each exam room contained three Apple iPod Touches (6th generation) with a charging station*. Each iPod Touch included an iOS application (Jacoti Lola, Wevelgem, Belgium) that provided wireless, low latency, peer-to-peer high-quality (CD quality) sound transmission over Wi-Fi without hardwiring connections between providers and patients. The Lola app and the iPod Touch were chosen to provide a comfortable, non-intimidating assistive listening experience. All devices were configured to run in "single-app" or kiosk mode so that (a) only the Lola app could be accessed by users, and (b) all devices connected automatically to the appropriate Wi-Fi network.[10] In each room, two iPod Touches were set up as speech transmitters (*Sender*), and one iPod Touch was configured as a receiver (*Listener*). (One iPod touch served as a backup *Sender* or *Listener*.) Volume controls for both *Sender*s and *Listeners* could be manipulated by the user.

*While there are differences in function between iOS devices, they all operate in the same manner for the use case described here and the Lola app works identically on all iOS devices.

The healthcare provider wore a lavalier (lapel) microphone (Sennheiser ClipMic Digital, Wedemark, Germany) clipped near the mouth (on the collar or neckline of the shirt). A lavalier microphone was attached to each *Sender* via a lightning cable, and the *Sender* was placed in a pocket. The patient was provided with a *Listener* containing standard headphones (Sennheiser 202, OTE-style) and either held the *Listener* or placed it in their lap.

The hospital-approved sanitation protocol consisted of disposable earphone guards for the ear cushions and alcohol wipes to wipe down the earphone cushions and headband after each use. At the end of the clinic day, disinfecting disposable wipes (Super Sani-Cloth Germicidal Disposable Wipe, PDI, Woodcliff Lake, NJ) was used to disinfect all iPod Touches.

Training was delivered to the director of otolaryngology, registration staff in the otolaryngology clinic, audiologists from the audiology clinic, representatives from information technology, and various administrative departments. An initial presentation covered the effects of hearing loss on communicative efficiency and health, the purpose of the proposed smartphone intervention, and a

demonstration of the technology and its use. In addition, videotapes on the use of the technology and troubleshooting problems were developed and distributed to the healthcare providers involved in the intervention. Further one-on-one training of the healthcare providers and equipment installation and setup occurred onsite over three days.

Questionnaire

A brief, one-page, paper-based survey was developed to assess patient opinions and attitudes regarding the impact of the smartphone-based technology on communicative efficiency during patient-provider interactions and its ease of use. Patients rated the statements on a seven-point Likert scale from strongly agree to strongly disagree. One item was reverse-worded to avoid participant response set (and scores for the reverse-worded item were reversed before summing). One Spanish speaker translated the survey into Spanish, and another Spanish speaker back-translated the Spanish version into English to ensure version equivalence.

Two items (#1 and #2) represented a self-report on hearing difficulty in quiet and noisy situations. Two items (#3 and #4) sampled opinions on the efficacy of the intervention in enhancing communicative efficiency during patient-provider interactions. Two items (#5 and #6) sampled opinions on the usability of smartphone technology. One item (#7) examined intervention effect on patient activation status to obtain a single measure of the patient rating of the impact of the intervention on patient-provider communication. The median rating across items #3 and #4 was obtained.

Similarly, to obtain a single measure of patient rating of usability of the smartphone devices, the median rating across items #5 and #6 was obtained. The median rating on item 7 reflected the effect of the intervention on patient activation. The median rating across five items (#3 through #7) yielded a single measure of overall intervention efficacy during patient-provider communication.

Results

All patients (N = 44) who were asked to participate in the intervention consented to participate and completed the survey (19 in the English language version; 25 in the Spanish language version). Of the 8 healthcare providers, 3 (2 nurse practitioners and 1 otolaryngologist) participated in the intervention.

The percentage frequency distributions reveal that slightly less than half of the participants self-reported hearing difficulty in quiet, and slightly more than half of the participants self-reported hearing difficulty in noise (**Table 1**). The overwhelming majority (88.4% to 90.9%, depending on the survey item) of patients reported favorable opinions about the efficacy and usability of the iPod Touch running Lola during patient-provider communication. A small minority of patients (2.3% - 6.95%, depending on the survey item) reported unfavorable opinions about the efficacy and usability of the technology. (**Table 1**). A markedly higher percentage of patients strongly agreed than disagreed/strongly disagreed (by a factor of 6.7 to 17.8) that the Lola wireless assistive technology intervention made it easier to hear hospital workers, improved hospital communication, and that they wanted to use the devices at the next hospital visit (**Table 1**).

Survey Item	Strongly agree (%)	Agree (%)	Neither agree nor disagree (%)	Disagree (%)	Strongly disagree (%)
#1. I usually have trouble hearing conversation when it's quiet	18.6	25.6	16.2	25.6	14
	44.2		39.6		
#2. I usually have no trouble hearing conversation in noisy situations	14	18.6	11.6	27.9	27.9
	32.6		55.8		
#3. I feel that the Lola device made it easier to hear hospital workers	46.5	41.9	4.65	4.65	2.3
	88.4		6.95		
#4. I feel that the Lola device improved communication in the hospital	40.9	47.7	6.8	2.3	2.3
	88.6		4.6		
#5. I feel that Lola was easy to use	40.9	50	6.8	0	2.3
	90.9		2.3		
#6. I want to use the Lola device the next time I visit the hospital	47.7	43.2	4.5	2.3	2.3
	90.9		4.6		
#7. I feel that the Lola device made me more confident in expressing my needs and concerns in the hospital	38.6	50	6.8	2.3	2.3
	88.6		4.6		

Table 1. **Percentage Frequency Distribution of Respondent Ratings On Each Survey Item**

The median rating for each of the 5 survey items relating to the patient assessment of the smartphone intervention ranged from 1.5 (between favorable and strongly favorable i.e., between agree and strongly agree) to 2 (favorable i.e., agree) (**Table 2**). Furthermore, the median rating of the impact of the smartphone assistive listening technology on patient-provider communication was 1.5, between strongly agree and agree (based on items #3 and #4). In addition, the median patient rating of the usability of the assistive technology was 1.5 (based on items #5 and #6), and the median patient rating of the assistive technology on patient activation (based on item #7) was 2 (agree). Finally, the median rating of the overall efficacy of the intervention was 1.6 (based on items #3-#7), indicating an overall rating between highly favorable and favorable regarding the impact of the intervention on patient-provider communication.

Survey Item and its description	Scale range	Median	Range
#3. I feel that the Lola device made it easier to hear hospital workers (assessment of patient-provider communicative interaction)	1= strongly agree, 5 = strongly disagree	1.5 (between agree and strongly agree, between favorable and strongly favorable rating)	1 – 5
#4. I feel that the Lola device improved communication in the hospital (assessment of patient-provider communicative interaction)	1= strongly agree, 5 = strongly disagree	2 (agree, favorable rating)	1 – 5
#5. I feel that the Lola device was easy to use (assessment of usability)	1= strongly agree, 5 = strongly disagree	2 (agree, favorable rating)	1 - 5

#6. I want to use the Lola device the next time I visit the hospital (assessment of usability)	1= strongly agree, 5 = strongly disagree	1.5 (between agree and strongly agree, between favorable and strongly favorable rating)	1 - 5
#7. I feel that the Lola device made me more confident in expressing my needs and concerns in the hospital (assessment of patient activation level)	1= strongly agree, 5 = strongly disagree	2 (agree, favorable rating)	1 - 5

Table 2. Median Ratings and Ranges for Survey Items (#3 - #7) Relating To Efficacy of the Smartphone Intervention

The nonparametric correlation coefficients (Spearman's rank correlation coefficients) between patient self-report on hearing difficulty and overall patient assessment of the efficacy of the smartphone technology intervention was negligible and nonsignificant in quiet (r = -.16, p > .05) and noise (r = .24, p > .05), respectively. Thus, self-report on hearing difficulty in quiet and in noise did not influence the patient's overall assessment of the smartphone technology intervention.

Median ratings of the overall efficacy of the intervention were 1.5 and 2.0 for the Spanish and English language surveys, respectively. The results of the nonparametric Wilcoxon rank-sum test revealed no significant difference in median ratings of overall efficacy (based on items #3-#7) of the smartphone technology intervention between the Spanish and English language surveys (p > .05).

Discussion

The purpose of this quality improvement pilot study was to investigate the impact of smartphone technology during clinical examinations on (a) patient-provider communication and patient activation level and (b) on the usability of the technology in an otolaryngology head and neck clinic of an urban hospital serving a community with a large Hispanic/Latino population:

- Nearly 90% felt that the intervention enhanced the efficacy of patient-provider communicative interactions and increased patient activation.
- Approximately 90% judged the usability of the technology favorably.
- Both Spanish-speaking and English-speaking patients judged the smartphone technology to be efficacious in enhancing patient-provider communicative interactions and patient activation.
- The impact of the intervention was perceived as beneficial, regardless of whether patients reported having hearing difficulty.

This is the first study of smartphone-based assistive listening on patient-provider interactions during clinical examinations in a hospital setting to the best of our knowledge. From the patient perspective, smartphone-based assistive listening significantly overcame patient-provider communication barriers without restricting the healthcare provider's movements. These findings extend the application of the technology from provider-provider applications[9] to patient-provider applications in the hospital setting. Based on the finding that this intervention provided communicative benefit regardless of whether the patient has self-reported hearing difficulty, patients without hearing difficulty should not be excluded from the intervention. The beneficial

impact for both Spanish-speaking and English-speaking patients indicates the applicability of the smartphone technology intervention on a diverse patient population.

Another advantage of the intervention is its relatively low cost, essentially a one-time expenditure of under $900 per clinical examination room. The cost would likely decrease with assistive listening technology specifically built for this use. Additionally, while the intervention does not necessarily require patient ownership of a smartphone, patients with iOS devices and earphones can download the Lola app for free to their device and connect to the exam room's password-protected network. As a result, fewer than three *Receiver* devices per exam room may be required, reducing cost.

The importance of this intervention in the healthcare process is underscored in this present--and likely to be long-lasting – COVID-19 environment. Persons with a hearing loss already experience difficulty in communicative interactions and the use of facial masks, especially in conjunction with social distancing, only further degrades communicative efficiency.[11]

A limitation of this intervention was that five healthcare providers did not employ the technology during their clinical examinations. They likely prioritize the performance of an unconstrained physical exam rather than providing a real-time explanation. This underscores the need for more healthcare provider awareness of (1) the importance to patients to hear and understand the entirety of the visit; and (2) how, as this study demonstrates, smartphone-based assistive listening can facilitate such communication. Audiologists are the appropriate professionals to furnish this education to other healthcare providers and oversee the intervention.

Another limitation was minor Wi-Fi connectivity issues, which were resolved by configuring replacement devices as a *Listener* or *Sender*. This limitation was also reported in a previous investigation on smartphone technology for communication among healthcare providers.[9]

A third limitation is that smartphone technology intervention requires personnel oversight of the instrumentation. For this study, a staff member was assigned to collect the iPod Touches at the end of the clinic day, locking them in the medication room, and then distributing them to the examination rooms for the following clinical session. Probably because of this oversight, no devices were lost or stolen during the pilot intervention.

Future research is needed to evaluate the use of smartphone technology from the patient's perspective over a long-term period in various settings within the hospital. Future research also is required to examine the efficacy of the smartphone patient-provider intervention from the healthcare provider's perspective. Given the well-established relations between poor patient-provider communication due to hearing loss and adverse health and health-related outcomes, smartphone technology intervention, which mitigates patient-provider communication barriers, ultimately has potential for positive impacts on health and related health outcomes.[5,7,9,12–20]

Acknowledgments

We thank Jacoti BVBA (Wevelgem,Belgium and Barcelona, Spain), a hearing health technology software developer, for providing equipment and logistical support for this study. Also, we gratefully acknowledge Kathy Muldoon, Dr. Robert Hendler, and Kent Weimer for their many contributions and support. Finally, we would like to thank Dr. Alan Silverman, a co-author in this

study, for inspiring this project.

Conflicts of Interest: Richard Einhorn consults for Jacoti.

References

1. Oleksy AJ and Schlesinger JJ. What's all that noise-improving the hospital soundscape. J Clin Monitor Comput 2019;33(4):557–562. doi: 10.1007/s10877-018-0215-3
2. Pope D. Decibel levels and noise generators on four medical/surgical nursing units. J Clin Nursing 2019;19(17-18):2463-2470. doi: 10.1111/j.1365-2702.2010.03263.x
3. Shukla A, Nieman CL, Price C, et al. Impact of hearing loss on patient-provider communication among hospitalized patients: A systematic review. Am J Med Qual 2019;34(3):284-292. https://doi.org/10.1177%2F1062860618798926
4. Stevens MN, Dubno JR, Wallhagen MI, and Tucci DL. Communication and healthcare: Self-reports of people with hearing loss in primary care settings. Clin Gerontol 2019;42(5):485-494. https://doi.org/10.1080/07317115.2018.1453908
5. Chang JE, Weinstein BE, Chodosh J, et al. Difficulty hearing is associated with low levels of patient activation. J Am Geriatr Soc 2019;67:1423-1429. doi: 10.1111/jgs.15833
6. Mick P, Foley DM, and Lin FR. Hearing loss is associated with poorer rating of patient-physician communication and healthcare quality. J Am Geriatr Soc 2014;62(11):2207-2209. doi:10.1111/jgs.13113
7. Mikkola TM, Polku H, Sainio P, et al. Hearing loss and use of health services: a population-based cross-sectional study among Finnish older adults. BMC Geriatrics 2016;16(1):1-11. doi: 10.1186/s12877-016-0356-5
8. McKee MM, Moreland C, Atcherson SR, and Zazove P. Hearing loss: Communicating with the patient who is deaf or hard of hearing. FP Essentials 2015;434:24-28.
9. Salehi HP. Smartphone for healthcare communication. Journal of Healthcare Communications 2018;3(3:34). doi: 10.4172/2472-1654.100144
10. Apple platform deployment. Fall 2021
11. Goldin A, Weinstein B, and Shiman N. How do medical masks degrade speech reception? The Hearing Review 2020. Available at: https://www.hearingreview.com/hearing-loss/health-wellness/how-do-medical-masks-degrade-speech-reception
12. Loughrey DG, Kelly ME, Kelly GA, et al. Association of age-related hearing loss with cognitive function, cognitive impairment and dementia: A systematic review and meta-analysis. JAMA Otolaryngol Head Neck Surg 2018;144(2):115-126. doi:10.1001/jamaoto.2017.2513
13. Mick P, Foley D, Lin F, & Pichora-Fuller MK. Hearing difficulty is associated with injuries requiring medical care. Ear Hear 2018;39(4):631-644.

14. Stam M, Smit JH, Twisk JWR, et al. Change in psychosocial health status over 5 years in relation to adults' hearing ability in noise. Ear Hear 2016; 37, 680-689.

15. Barnett DD, Koul R, and Coppola NM. Satisfaction with health care among people with hearing impairment: a survey of Medicare beneficiaries. Disabil Rehabil 2014;36(1):39-48. doi: 10.3109/09638288.2013.777803

16. Genther DJ, Frick KD, Chen D, et al. Association of hearing loss with hospitalization and burden of disease in older adults. JAMA 2013;309(22):2322-2324. doi:10.1111/jgs.13456

17. Hsu AK, McKee M, Williams S, et al. Associations among hearing loss, hospitalization, readmission and mortality in older adults: A systematic review. Geriatric Nursing 2019;40:367-379. https://doi.org/10.1016/j.gerinurse.2018.12.013

18. Lin HW, Mahboubi H, and Bhattacharyya N. Hearing difficulty and risk of mortality. Ann Otol Rhinol Laryngol 2019;128(7):614-618. https://doi.org/10.1177%2F0003489419834948

19. Simpson AN, Simpson K, and Dubno JR. Higher health care costs in middle-aged US adults with hearing loss. JAMA Otolaryngol – Head Neck Surg2016; 142(6):607-608.

20. Lin FR and Whitson HE. The common sense of considering the senses in patient communication. J Am Geriatr Soc 2007;65(8):1659-1660. https://doi.org/10.1111/jgs.14926