

Interactive Voice Response Technology: A Tool for Improving Healthcare

Margaret Ross Kraft, PhD, RN¹ , Ida Androwich, PhD, RN, FAAN²

¹Loyola University Chicago, Chicago, IL, USA · ²Loyola University Chicago, Chicago, IL, USA

Abstract

The integration of telephony with computers has created interactive voice response technology that has begun to have many applications for healthcare. This technology has turned touch-tone phones into virtual computer terminals. A number of IVRT applications have been developed with nursing involvement. Research on IVRT use shows major applications dealing with chronic disease management, medication management and the care of special populations. . It will be up to Nurse Informaticists to develop and test creative uses for IVRT that will both leverage technology and improve patient care. Use of the IVRT provides opportunities to educate as well as to monitor individuals on their self-management behaviors. As an understanding of the uses of IVRT in patient care grows, it will offer added value to healthcare services.

Introduction

Healthcare has moved from the Industrial Age to the Information Age. In the Industrial Age care was episodic, provided in a traditional setting and was provider centric. Clinical data was interpreted by providers based on memory, intuition and pattern recall. New knowledge was developed in research settings. In the current Information Age, care is ongoing, customized and centered around the patient. Clinical data is supported by clinical decision support systems, alerts, reminders and evidence. New knowledge is often a by-product of patient care. Healthcare has moved from the translation of research into practice to translating practice into research¹. One of the tools supporting these changes is Interactive Voice Response Technology (IVRT) that automates interactions with telephone callers and communication systems. IVRT is a type of telephone system that interacts with most users through voice commands.

Interactive voice response (IVRT) is a technology of the Information Age. This technology has turned touch-tone phones into virtual computer terminals. Initially IVRT was used for automated telephone interactions using pre-recorded voice prompts and touch-tone keypad menus. Advances in technology using voice recognition now allow for input and responses gathered from the spoken word and IVRT has become a method of patient communication and data collection increasingly recognized as an advancement in health information technology.

IVRT History

Research in speech technology predates digital computers. At the 1939 World's Fair, Bell Labs displayed a device called "The Voder" which was a speech synthesis project. The Bell System later developed a tone dial methodology unveiled at the Seattle World Fair in 1962. This dial tone multi-frequency (DTMF) technology allowed the transmission of audible tones in the frequency range of the human voice². The automation of call center tasks began in the 1970s and by the 1980s, IVR technology use began to increase. The development of speech recognition allowed for input and responses to be gathered from the spoken word expanding the use of IVRT. This major integration of computers and telephony has led to a less expensive and increasingly more common use of IVR technology.

IVRT Applications

Although IVRT applications in healthcare have not been fully explored, IVRT is proving to be a technology that offers nurses creative uses in caring for specific patient populations. Research on IVRT use shows major applications dealing with chronic disease management, medication management and the care of special populations.

These populations include vulnerable and underserved groups, older persons, those with chronic illnesses such as diabetics, heart disease or mental illness. IVRT can be useful for persons dealing with tobacco and substance abuse. IVRT also offers a way to address individuals with health literacy issues.

General uses of IVRT include pre-treatment questionnaires, surveys such as patient satisfaction with treatment, post discharge follow-up, outcomes monitoring, care coordination and home monitoring. This technology is useful in tracking patient information and can be used to for decision support with automated alerts and reminders. In addition, IVRT provides access to information and appropriate resources. Piette³ has recommended further study to see if IVRT assessment data could improve problem prediction and outcome evaluation of chronic disease management and outcome evaluation.

Chronic Disease Management. A study of the functions of an IVRT system for diabetes care suggested use of the system for dietary advice, information about the disease, self-care, reminders about lab tests and appointments, tracking of lab results and feedback on self-monitoring⁴. This technology has been successfully used in a peer-support program for persons with diabetes⁵. An early study demonstrated that income level was not a barrier to IVR access and participants who had a primary language of Spanish were able to use the Spanish version of the message system effectively even though elderly with little or no formal education⁶. A study that followed the automated call for diabetic management with a call from a diabetes nurse educator found patients reported better self-care with lower HgA1C levels, less depression, fewer bed days and increased satisfaction with care⁷. A reciprocal peer support program studied the use of IVRT vs nurse care management⁸ using a telephone platform that recorded call occurrence and gave reminders for peer contact was seen as a successful way to manage diabetes.

Medication Compliance. IVRT has also been evaluated for its effect on medication adherence and BP control with hypertensive patients. Over 200 patients from 29 communities in the greater Boston area received a weekly call related to BP, medication knowledge and adherence to the medication regimen. The increased adherence to the medication regimen and the increase in patient satisfaction, IVRT was seen as a cost-effective intervention in this population⁸.

A Canadian study⁹ found IVRT used to promote adherence to prescribed medications should target those individuals with complex medication regimes or reported memory problems. This study did find that some participants were not receptive to an automated voice. Another study used an IVRT system to communicate INR tests and dosage schedules for anticoagulation therapy as well as reminders about appointments for blood tests. This use of IVRT significantly reduced staff workloads and over 75% of study participants chose to remain in the IVT system when the study was completed.¹⁰

Substance Abuse. A nursing study using IVRT to prescreen clinical patients for tobacco use resulted in an increase in the discussion of smoking cessation during the clinic visit and was seen as a good way to support health information¹¹. Adolescents in an alcohol/drug treatment program agreed to participate in a 14 day IVR call check and the use of IVRT for daily reports on alcohol/drug use was seen as a way to predict relapse.¹² Relapse is common in adolescents but the use of IVRT for a daily report was seen as a way to prevent relapse.

Mental Illness. An eight week telephone-based self-help program for patients with mild to moderate depression, COPE, uses cognitive-behavior therapy and provides baseline and weekly assessment. COPE is designed for inclusion in employee assistance programs with 24 hour availability. 75% of users have found it to be both helpful and easy to use.¹³ COPE is seen as a value added program that requires very little staff time while providing reliable and valid patient evaluations. IVRT studies have identified usefulness in detection of impaired cognitive functioning and as a result, a battery of tests now exists to evaluate changes in cognitive functioning over time.

Data Collection. A variety of assessment tools are currently available for IVRT use. These include rating scales, longitudinal patient monitoring and evaluation tools, quality of life assessments and functional assessments. IVRT has also proven very successful in the collection of race and ethnicity data.¹⁴ A Harvard study that compared the use of IVRT system with pre-recorded questions showed no difference in scores on written questionnaires.¹⁵

Post-Discharge Monitoring. The transition from hospital to home can pose considerable risks to patients. The national rate of re-hospitalization is about 19.6% but patients monitored after discharge have a re-hospitalization rate

of 6.5%.¹⁶ The use of an IVRT system for post-discharge monitoring can identify patients with new or worsening symptoms, medication problems, or the need to talk to a nurse. Foster & Van Walraven¹⁷ found the use of IVRT for such monitoring did identify potential complications and decreased re-hospitalization rates. Patients have been found to be accepting of IVRT monitoring.¹⁸

IVRT in Research.

There are both pros and cons for the use of IVRT in clinical research. The technology does offer easy access because of familiarity with telephones. The online interviews and surveys can be kept consistent. Literacy skill of the participant is not a limiting factor. IVRT offers real-time data collection and tracking of study events. Study participants can choose when to take a survey or do an interview. Reminders are automated.

Not all research instruments have been validated for use with IVRT. The telephone service may create Interruptions. Scripts to be used require validation and should be pilot-tested. Participants may also need training. Staff to program and maintain the IVRT system may be an added cost.¹⁹ The technology does require that the participant has a touch-tone phone. The use of a cellular phone may result in a lost connection due to range of reception.

Nursing Informatics and IVRT.

A number of IVRT applications have been developed with nursing involvement. McDaniel²⁰ found that IVRT was a useful and acceptable method for nursing assessment and intervention allowing a clinical nurse specialist to “do more with less” at a relatively low cost. The use of automated assessments and self-help programs can free up nursing time and help to focus on priorities during a patient visit. Better collection of patient outcomes can support evidence-based practice. Nurses involved in informatics are becoming involved in the functional evaluation of uses of IVRT. They also address attitudes about new technologies and promote acceptance and adoption of IVRT for specific populations. It will be up to Nurse Informaticists to develop and test creative uses for IVRT that will both leverage technology and improve patient care.

IVRT Benefits

Because most patients are familiar with and have access to telephones, IVRT is an enabling technology that is likely to transform the provider-patient relationship. Consumers and providers have accepted this technology. Use of the IVRT provides opportunities to educate as well as to probe individuals on their self-management behaviors. Spoken messages may be more effective with individuals who have low literacy levels since statements and questions can be repeated as often as necessary. Calls may be conducted in other languages such as Spanish. Some patients may perceive a computer-generated language as less threatening than a personal discussion. The technology provides consistency in interviews. Data can be collected and stored on a ‘real-time’ basis.

Healthcare systems face the challenge that to provide services to patients in a simple, easy to use, accessible way. Economic pressures and accountability for performance require the use of information technology in the provision of quality cost-effective and value-based care. As an understanding of the uses of IVRT in patient care grows, it will offer added value to healthcare services. Consumers will be empowered to be an active participant in their own healthcare. IVRT has the potential to provide added value in the transformation of healthcare systems.

References

1. Perlin JB, Kolodner RM, Roswell RH. The Veterans Health Administration: Quality, value, accountability, and information as transforming strategies for patient-centered care. *Am J Manag Care* 2004;10:828–836.
2. Juang B, Rabiner L. Automatic speech recognition – A brief history of the technology development. Available from: <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.90.5614>
3. Piette J. Interactive voice response systems in the diagnosis and management of chronic disease. *Am J Manag Care* 2000;6:817-827
4. Goldman R, Sanchez-Hernandez M, Ross-Degnan D, Piette J, Trinacty C, Simon S. Developing an automated speech-recognition telephone diabetes intervention. *International Journal for Quality in Health Care* 2008; 20(4): 264-270
5. Heisler M, Vijan S, Makki F, Piette, J. Diabetes control with reciprocal peer support vs nurse care management: A randomized trial. *Annals of Internal Medicine* 2010;153(8)8:507-515.

6. Piette J, McPhee S, Weinberger M, Mah C, Kraemer, F. Use of automated telephone disease management calls in an ethnically diverse sample of low-income patients with diabetes. *Diabetes Care* 1999;22(8):1302-1309.
7. Piette J, Weinberger M, McPhee S. The effect of automated calls with telephone nurse follow-up on patient-centered outcomes of diabetes care. *Medical Care* 2000;38(2):218-230.
8. Friedman R, Kazis L, Jette A, Smith M, Stollerman J, Torgerson J, Carey K. A telecommunication system for monitoring and counseling patients with hypertension: Impact on medication adherence and BP control. *American Journal of Hypertension* 1996; 9:285-292.
9. Reidel K, Tamblyn R, Patel V, Huang A. Pilot study of an interactive voice response system to improve medication refill compliance. *BMC Medical Informatics and Decision Making* 2008;8(46):1-8.
10. Oake N, van Walraven C, Rodger M, Forster A. Effect of an interactive voice response system on oral anticoagulant management. *Canadian Medical Association Journal* 2009;180(9):927-933.
11. McDaniel A, Benson P, Roesener G, Martindale J. An integrated computer-based system to support nicotine dependence treatment in primary care. *Nicotine & Tobacco Research* 2005;7(Supp 2):S57-S66.
12. Kaminer Y, Litt M, Burke R, Bursleson J. An interactive voice response (IVR) system for adolescents with alcohol use disorders: A pilot study. *The American Journal on Addictions* 2006;15(Supp 1):122-125.
13. Greist JH, Osgood-Hynes DJ, Baer L, Marks IM. Technology-based advances in the management of depression. Focus on the COPE program. *Disease Management & Health Outcomes* 2000;7(4):193-200.
14. COPE. http://www.healthtechsys.com/products/edcare_cope.html. Downloaded on Sept 9, 2011.
15. Lam M, Lee H, Bright R, Korzenik J, Sands B. Validation of interactive voice response system administration of the Short Inflammatory Bowel Disease Questionnaire. *Inflammatory Bowel Disease* 2009;15(4):599-607.
16. Gawande A. Hot spotters. *The New Yorker* 2011 January 24:40-51.
17. Forster A, van Walraven C. Using an interactive voice response system to improve patient safety following discharge. *Journal of Evaluation in Clinical Practice* 2007;13:346-351.
18. Forster A, Boyle L, Shojanian K, Feasby T, van Walraven C. Identifying patients with post discharge care problems using an interactive voice response system. *Journal of General Internal Medicine* 2009;24(4):520-525.
19. Abu-Hasaballah, James A, Aseltine R. Lessons and pitfalls of interactive voice response in medical research. *Contemporary Clinical Trials* 2007;28:593-602.
20. McDaniel A. Interactive voice response technology for outcomes monitoring. *Clinical Nurse Specialist* 2004;18:7-8.