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The Value of Automated Audiometry

Robert H. Margolis, Ph.D. & Donald E. Morgan, Ph.D.

Biography

Robert H. Margolis earned his Ph.D. degree from the University of Iowa (1974). He is a professor of audiology at the University of Minnesota Medical School, as well as the president of Audiology Incorporated. Dr. Margolis has over 120 publications in scientific and clinical journals and textbooks. His current research is the development and clinical validation of automated tests of hearing.

Donald E. Morgan, Ph.D. is President of Hearing Resource Group, Inc., a consulting and management services company providing business and clinical solutions for ENT-based Audiology Practices.

Abstract:

Although automated pure-tone testing methods have existed for many years, they have not been used extensively for diagnostic audiometry. A commercial system that appeared a few years ago has stimulated a great deal of discussion, not just related to the clinical and scientific issues, but on professional and ethical issues as well. In this article we focus on the rationale for implementing validated automated hearing test methods, the potential impact on the hearing professions, and issues related to reimbursement, which go to the central question of the value of the pure-tone audiogram.

Automated diagnostic audiometry defined

Certain aspects of pure-tone audiometry have been implemented in automated procedures for many years. Pure-tone screening tests are available, for example, that present a series of tones at pre-determined levels. The Bekesy tracking method, an automated pure-tone test, was used in clinical Audiology for many years, primarily as a "site of lesion" test. "Automated Hughson-Westlake" procedures are used primarily for industrial hearing testing. With few exceptions, these methods have not included bone-conduction testing and have not used contralateral masking. Bone conduction and masking add a great deal of complexity to the task of automating pure-tone testing.

Advances in technology now make it feasible to automate diagnostic pure-tone audiometry, which must include both bone conduction testing and contralateral masking (when appropriate). In fact, pure-tone audiometry is well-suited to automation because

1. Testing is performed by executing a sequence of steps, the rules for which are well established (although not always followed) and can be implemented by computer.
2. Modern audiometers are PC-based or utilize internal microprocessors that can implement a software-based testing system.
3. Information regarding test accuracy, which is monitored (sometimes unconsciously) by experienced testers can be tracked and quantified by computer.
4. Automated testing facilitates communication with other software systems such as medical records, hearing aid fitting systems, and automated interpretation tools (such as AMCLASS™ - see www.Audiologyincorporated.com).
5. There is a recognized need for standardization of hearing testing, which is unlikely to occur with manual testing.
6. The use of highly-trained professionals for routine testing that can be performed by computer is inefficient and wasteful.

Relationship of hearing testing to Clinical Audiology

Audiology in the U.S. is transitioning to a doctoral-level profession. In view of the effort to be recognized as doctoral healthcare providers, it is appropriate to assess the professional activities that differentiate Audiologists from "technicians" who assess hearing sensitivity. There are numerous examples of "certification" programs which qualify minimally-trained individuals to "test hearing". Public school systems certify hearing screeners to administer the screening and follow-up tests required to identify school-age children with possible hearing loss. The VA has successfully employed technicians to administer basic hearing tests. It is increasingly common for hospital-based Audiology clinics, ENT offices, and Audiology private practices to employ technicians, sometimes called Audiology assistants, whose duties may include hearing testing. *continues*

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Audiologists are providers of hearing health care. The distinction between Audiologists and technicians are not in the conduct of hearing tests, but in the interpretation of test results, in the understanding of the relationships among test results and symptoms, in determining the impact of hearing loss on communication and quality of life, and in the knowledge necessary to determine the need for referral to other health professionals. These interpretive skills and the training necessary to recommend and implement rehabilitative strategies including hearing aids, cochlear implants, and aural rehabilitation are the basis for the position that Audiology is a doctoral-level profession. The manual administration of procedures that can be implemented efficiently and accurately by automated methods is inconsistent with duties usually associated with doctoral health-care professions.

Automated audiometry provides the potential for Audiologists to use their time more effectively for the delivery of doctoral-level activities, and to spend less time simply gathering the information on which those activities are partially based.

In addition, automated audiometry can decrease the cost of test administration. One patient can be tested while the Audiologist is counseling another patient, fitting a hearing aid, performing physiological tests, conferring with colleagues, and performing other doctoral-level activities. The cost saving accrues from the more efficient use of professional time.

Automated audiometry also has the potential to increase access to hearing testing, and provide service to a larger segment of the underserved population. Automated systems that provide valid results potentially enable a greater number of individuals to be tested without an increase in professional personnel to conduct the tests. Audiologists provide interpretation of the test results, determine the need for further testing or referral, and develop a management plan. This approach lends itself well to telemedicine, with its great potential to increase access to services.

One concern that has been raised concerning automated audiometry is the possibility that primary care physicians (and other purchasers of automated systems) might "over-utilize" such equipment and circumvent the involvement of the Audiologist in the provision of hearing care. Historically, PCPs have demonstrated their commitment to make maximal efficient use of their resources (time, space and personnel) in the care of their patients. There is no compelling evidence that they will abuse the utilization privilege, or that they will leave the Audiologist out as providers of care. It is the responsibility of those in the Audiology profession to demonstrate to PCPs their value in the provision of care to those with hearing loss. Primary care practitioners are anxious to identify for their patients the best providers of specialty care. Audiologists should partner with PCPs by:

- providing instruction in the use of screening and/or automated test systems;
- providing efficient referral systems for patients in need of advanced audiologic evaluation procedures and audiologic rehabilitation;
- establishing the members of our profession as the highest quality and most efficient referral choice for patient care; and
- embracing automated audiometry as an efficient means by which the underserved can be identified and provided appropriate care.

Finally, the issue of automated audiometry raises the question as to whether automated and manual hearing tests should be associated with separate billing (CPT) codes. The question relates to whether reimbursement should be based on a "process" (manual vs. automated) or the value of a "product" (the audiogram and its interpretation). If we argue that the codes be associated with a "process" we run a very high risk of establishing a precedent that will penalize those Audiology practices that embrace technological advances and enable more efficient use of our time as Audiologists in direct patient care. Furthermore, the establishment of two codes for the same test with different reimbursement rates will encourage payers to mandate the lower cost procedure.

The bottleneck to access

When automation begins to perform tasks that were previously performed by humans, there is a natural concern for the impact on employment. In the case of one previous automated audiometry product, that fear was exacerbated by direct marketing to physicians in a manner that was widely interpreted as a strategy for replacing Audiologists with machines.

When market realities of supply and demand for audiograms are examined, that fear is clearly shown to be unfounded. There is such a huge gap between the supply (the capacity of health professionals to perform audiograms) and the demand (the number of people that need to be tested every year) that it becomes clear that without automated testing there will continue to be a severe limitation in access to hearing testing. And the gap is expected to increase dramatically.

How many people need diagnostic hearing tests every year? This is a very difficult number to determine but we will offer an estimate here based on U.S. statistics. The number is composed of the following groups.

1. People with significant, handicapping hearing loss
2. People without significant hearing loss who are seen for hearing testing for a variety of reasons including (but not limited to) the following:
   a. acute or transient ear disease who are seen for complaints such as ear pain, aural fullness, tinnitus, dizziness
   b. People who require hearing tests as part of employment physical examinations
   c. People who are seen for pre- or post-treatment evaluations
   d. People who are self-referred or referred by friends and family members

A popular estimate for Group 1 is 28 million, 10% of the 2000 population[1]. The 10% prevalence is projected to increase as the population ages. From U.S. census data[2], we can obtain the projected increase in the population of the over 65 group, and then determine the affect of population aging on the overall prevalence of hearing loss. The prevalence of hearing loss in the over 65 group is 31%[3]. The projected increase in the proportion of the over 65 population leads to an expected increase in overall prevalence of hearing loss from 10% in 2000, to 12% in 2050. The overall population is projected to increase from 282 million in 2000 to 420 million in 2050. This would result in an increase in the number of hearing impaired in the U.S. from 28 million in 2000 to 50 million in 2050.

Group 2 represents people with clinically normal hearing who are seen for hearing testing. An analysis of a large clinical database from a university hospital Audiology clinic indicated that this group represents about 25% of the total number of patients seen for hearing testing (Margolis & Saly, 2007). With population growth this number will increase from about 2 million in 2000 to 3.75 million in 2050.

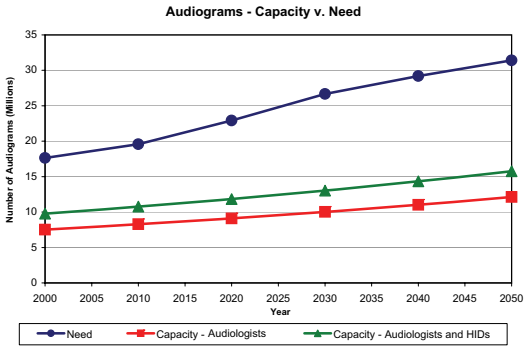
Although it is common to recommend that people with significant, chronic hearing loss be tested once a year, once every two years is probably a more realistic goal. Thus, the total annual need for hearing testing is calculated to be half of Group 1 (one test every two years) plus 25% (Group 2). The annual need for hearing testing could increase from 16 million in 2000 to 29 million in 2050.

Perhaps a trickier question is, "What is the capacity of hearing professions to provide the needed testing?" If we assume that all of the hearing testing is performed by Audiologists, we can estimate the capacity from the number of Audiologists and the number of audiograms they perform in the average workday. The Bureau of Labor Statistics reports that 10,910 Audiologists were employed in 2006[4]. Projecting the number of Audiologists in future years is difficult but some (including the Department of Labor) argue that the transition to the Au.D, the increased educational requirements, and the closure of masters degree programs that cannot convert to Au.D. programs will limit the growth of the profession. The number of employed Audiologists trended slightly downward from 2000 – 2004 and is trending slightly upward now. We will assume a growth rate of 1% per year. An analysis of Audiology activities of a hospital-based Audiology clinic conducted by the first author indicated that the average number of audiograms per Audiologist per workday was about two. In ENT-based clinics managed by the second author the average is about four. For this analysis we will use an estimated average number of audiograms per day per Audiologist of three.

Of course all hearing testing is not performed by Audiologists. Some testing, such as school and industrial testing, functions as screening procedures used to refer people for more complete testing and does not impact these estimates. Testing by non-audiologist hearing-instrument dispensers, in some cases, may substitute for the diagnostic hearing testing performed by Audiologists. There are 3000 members of the International Hearing Society, the professional association of hearing instrument dispensers in the U.S[5]. This number has not been increasing because of the greater numbers of dispensing Audiologists providing hearing aid services. We will assume a 1% annual increase in the number of non-audiologist hearing-instrument dispensers.

The resulting projections of the capacity and need for hearing testing is shown in the figure. It is clear that there is a huge gap between the need for audiograms and the capacity of hearing professionals to provide testing. The difference between the need and the capacity is over six million audiograms in 2000 and increases to thirteen million in 2050.

There are a number of possible solutions to the limited availability of hearing testing. One solution is to increase the number of personnel. It is not likely that there will be a significant increase in the supply of Audiologists any time soon. One option is to train and employ



technicians for performing standard hearing testing, an idea that has a controversial history of its own. Another solution is to automate the testing, which will increase access and free the Audiologist for tasks that require their high level of skill. Furthermore, if automation facilitates a shift in professional activities toward those that require high-level skills, the change will be in alignment with the transition of Audiology to a doctoral profession. And that will be good for patients and good for the profession.

Conclusion

In an unpleasant meeting I (RHM) had with a hospital administrator, I was told that for the Audiology clinic to survive we would have to get more productivity out of the staff. When I complained that the staff was already overworked, she said "Well maybe you should automate some of those tests." More than once patients have asked me why I have to sit and push buttons when I had a computer right next to me. Sometimes things are more obvious to those who are not as intimately involved. Automation will and should be utilized to increase access to hearing services, allow better utilization of professional time, and decrease the cost of basic tests. If it doesn't happen by us it will happen to us.

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[3] *www.nidcd.nih.gov/health/statistics/hearing.asp#2*
[4] *www.bls.gov/search/search.asp - query: Audiologist*
[5] *www.ihsinfo.org*