1-17-2012 12:00 AM

An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0).

Sheila T F Moodie
The University of Western Ontario

Supervisor
Dr. Linda Miller
The University of Western Ontario

Graduate Program in Health and Rehabilitation Sciences
A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

AN INTEGRATED KNOWLEDGE TRANSLATION EXPERIENCE: USE OF THE NETWORK OF PEDIATRIC AUDIOLOGISTS OF CANADA TO FACILITATE THE DEVELOPMENT OF THE UNIVERSITY OF WESTERN ONTARIO PEDIATRIC AUDIOLOGICAL MONITORING PROTOCOL (UWO PedAMP v1.0)

(Spine Title: Integrated Knowledge Translation in Pediatric Audiology)

(Thesis format: Integrated Article)

by

Sheila Theresa Frances Moodie

Graduate Program in Health & Rehabilitation Sciences

A thesis submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

The School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

THE UNIVERSITY OF WESTERN ONTARIO
School of Graduate and Postdoctoral Studies

CERTIFICATE OF EXAMINATION

Supervisor

Dr. Linda Miller

Supervisory Committee

Dr. Richard Seewald

Dr. Anita Kothari

Dr. Susan Scollie

Examiners

Dr. Prudence Allen

Dr. Lisa Archibald

Dr. Ian Graham

Dr. Carol McWilliam

The thesis by

Sheila Theresa Frances Moodie

entitled:

An Integrated Knowledge Translation Experience: Use of the Network of Pediatric Audiologists of Canada to Facilitate the Development of the University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0)

is accepted in partial fulfillment of the
requirements for the degree of
Doctor of Philosphy

Date

Chair of the Thesis Examination Board

Abstract

The goals of this project were: (1) to determine the important factors that influence implementation of evidence-based practice by Canadian audiologists; and (2) to utilize the knowledge-to-action process (Graham et al., 2006) during the development of a guideline for outcome measures to evaluate the auditory development and performance of young children who wear hearing aids, to facilitate clinical uptake and identify barriers to implementation (Bagatto, Moodie & Scollie, 2010; Bagatto et al., 2011; Bagatto, Moodie, Seewald, Bartlett, & Scollie, 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011).

Two projects (Chapters 3 and 4) included the participation of The Network of Pediatric Audiologists of Canada.

The outcome measures guideline to evaluate the auditory development and performance of young children who wear hearing aids is called The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP).

This body of work includes a chapter on knowledge translation and how it can be used to promote the clinical implementation of evidence in audiology (Chapter 3). It also includes three studies: (1) an examination of factors influencing the use of evidence by Canadian audiologists [Chapter 2]; (2) an initial evaluation by the Network of Pediatric Audiologists of Canada of the individual components considered for inclusion in the UWO PedAMP [Chapter 4]; and (3) a final evaluation by the Network audiologists of the released version of the UWO PedAMP and associated training materials [Chapter 5].

Results of the first study indicated that Canadian audiologists rate themselves as competent in finding, evaluating and using research evidence to change practice. Their greatest barriers to evidence-based practice are related to time. By partnering with Canadian audiologists and using the knowledge-to-action framework to guide us (Chapter 4), we were successful in developing the UWO PedAMP guideline into what they rated as being a high-quality, systematic, hearing aid outcome evaluation tool that improves the quality and effectiveness of audiological care received by young children with hearing loss. The results presented in

Chapter 5 indicated that the UWO PedAMP is appropriate for clinical implementation, and is recommended by these Canadian audiologists as preferred audiology practice.

Keywords

knowledge translation, knowledge utilization, knowledge-to-action process, integrated knowledge translation, implementation, outcome measures, outcome evaluation, audiological monitoring, infants, children, hearing loss, hearing aids, Desired Sensation Level (DSL)

List of Abbreviations

AAA: American Academy of Audiology
AGREE: Appraisal of Guidelines Research and Evaluation Instrument
ANSD: auditory neuropathy spectrum disorder
ASHA: American Speech-Language-Hearing Association
AV: auditory verbal
AuD: Doctor of audiology
BARRIERS scale: Barriers to research utilization scale
CAA: Canadian Academy of Audiology
CAFAS: The Child and Adolescent Functional Assessment Scale
CAL: Child Amplification Laboratory
CASLPA: Canadian Association of Speech-Language Pathologists and Audiologists
CASLPO: College of Audiologists and Speech-Language Pathologists of Ontario
CCO: Cancer Care Ontario
CIHR: Canadian Institutes of Health Research
CoP: Community of Practice
CPG(s): Clinical Practice Guideline(s)
DEBP Questionnaire: Developing Evidence-Based Practice Questionnaire
DoI Theory: Diffusion of Innovations Theory
DSL: Desired Sensation Level
DVD: Digital Versatile Disk (formerly Digital Video Disk)
EBM: evidence-based medicine
EBMWG: evidence-based medicine working group
EBP: Evidence-Based Practice
HL: hearing loss
*i*KT: integrated knowledge translation
KT: knowledge translation
KTA process: Knowledge-to-Action process/framework
LittlEARS: LittlEARS® Auditory Questionnaire
MCHAS: Modernising Children's Hearing Aid Services
NCA: National Centre for Audiology
OIHP: Ontario Infant Hearing Program
PARiHS: Promoting Action on Research Implementation in Health Services
PaU: Practice as usual
PCHI: Permanent Childhood Hearing Impairment
PEACH: Parents' Evaluation of Aural/Oral Performance of Children
PEBC: Program in Evidence-based Care
RCTs: randomized controlled trials
SII: speech intelligibility index
SLPs: speech-language pathologists
TPB: Theory of Planned Behavior
UWO PedAMP v1.0: University of Western Ontario Pediatric Audiological Monitoring Protocol
VRA: visual reinforcement audiometry
WHO: World Health Organization

Co-Authorship Statement

This dissertation document includes an introductory chapter which offers background information to the project (Chapter 1); four integrated manuscripts (Chapters 2-5), two of which have been published (Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011); and a concluding chapter (Chapter 6). I, Sheila Moodie, am responsible for the conception and design of this body of work and the analyses and interpretation of the data. I am the primary author of all the manuscripts included in this document. I, Sheila Moodie, am responsible for the writing and content of Chapter 1. Chapter 2 was co-authored by Andrew Johnson, Linda Miller and Susan Scollie. Dr. Johnson consulted on the project methodology and statistical analyses for the manuscript. He reviewed and submitted the ethics application and received approval, however, I was responsible for its preparation. Dr. Miller provided guidance on statistical analyses for the manuscript. Dr. Johnson, Dr. Miller and Dr. Scollie reviewed and revised drafts of Chapter 2 to provide important intellectual content. All authors approved the final submitted version of Chapter 2. Chapter 3 was co-authored by Anita Kothari, Marlene Bagatto, Richard Seewald, Linda Miller and Susan Scollie. I, Sheila Moodie, am responsible for the literature review and am primary author of the manuscript. All co-authors reviewed and revised drafts of the manuscript to provide important intellectual content. All authors approved the final submitted and published version of Chapter 3. Chapter 4 was co-authored by Marlene Bagatto, Linda Miller, Anita Kothari, Richard Seewald, and Susan Scollie. Dr. Miller, Dr. Kothari, Dr. Seewald and Dr. Scollie reviewed and provided suggested revisions and gave final approval to the questionnaires used in Chapter 4. All co-authors reviewed and revised drafts of the manuscript to provide important intellectual content. All authors approved the final submitted and published version of Chapter 4. Chapter 5 was co-authored by Marlene Bagatto, Linda Miller, Anita Kothari, Richard Seewald, and Susan Scollie. Dr. Miller, Dr. Kothari, Dr. Seewald and Dr. Scollie reviewed and provided suggested revisions and gave final approval to the questionnaires used in Chapter 5. All co-authors reviewed and revised drafts of the manuscript to provide important intellectual content. All authors approved the final submitted version of Chapter 5. I, Sheila Moodie, was the sole author of Chapter 6. Dr. Miller, Dr. Kothari, Dr. Seewald and Dr. Scollie reviewed and provided suggested revisions and gave final approval to Chapter 6.

Acknowledgments

Mahatma Gandhi said that “Man often becomes what he believes himself to be. If I keep on saying to myself that I cannot do a certain thing, it is possible that I may end by really becoming incapable of doing it. On the contrary, if I shall have the belief that I can do it, I shall surely acquire the capacity to do it, even if I may not have it at the beginning.”

I want to start these acknowledgements by thanking all the people in my life that believed in me, and helped me to believe that I could be successful in obtaining my doctoral degree.

My Supervisor, Linda Miller, thank you for believing in me throughout this journey. You have been a tireless, dependable advocate, and an exemplary mentor. You continued to encourage me to explore the literature and develop this research work, even when it wasn’t always apparent which direction it would go. You made this journey happen for me and for that I will be eternally grateful.

My Advisory Committee, Richard Seewald, Susan Scollie and Anita Kothari. Anita, you helped bring perspective to this work. I appreciate your expertise in the area of knowledge translation. Your questions and inquisitive nature helped guide this work and expand my point of view. Susan, your support as Director of the Child Amplification Laboratory, as a colleague and a friend, allowed me the time and professional opportunity to undertake this work and develop expertise in the area of knowledge translation. This was all ‘new to us’ and you encouraged me to believe that I had the capacity to do this work, even during the times I doubted it myself. Thank you. Richard, you have been a constant believer in my abilities for over 22 years. I have been truly blessed to have you as a mentor and to be able to call you friend. I stand here today as Dr. Moodie in large part because of you. Thank you for continuing to support me and this work even during your early retirement years.

My Examination Committee, Prudence Allen, Lisa Archibald, Ian Graham, and Carol McWilliam. Thank you for committing the time and your expertise to reviewing my thesis document and actively participating in the oral examination process. Your comments and suggestions improved this final document. Thank you, Ian for traveling to London for the thesis presentation and examination.

The Network of Pediatric Audiologists of Canada, was developed as a component of this project. The members of this network are pediatric audiologists in various provinces across Canada. Their commitment to improving pediatric audiology services for young children with hearing loss and their families based on evidence-based practice principles is apparent when you read this thesis. I look forward to continuing and expanding our network as we commence new research projects.

Audiologists who make up the Network of Pediatric Audiologists of Canada are employed at sites including: Nova Scotia Hearing and Speech Centres, Halifax/Truro, NS; Montreal Children's Hospital – McGill University Health Centre, Montreal, QC; Children's Hospital of Eastern Ontario, Ottawa, ON; Hospital for Sick Children, Toronto, ON; Humber River Regional Hospital, Toronto, ON; Hamilton Health Sciences, Audiology, Hamilton, ON; The H.A. Leeper Speech and Hearing Clinic, University of Western Ontario, London, ON; Ear and Hearing Clinic, Kitchener, ON; Glenrose Rehabilitation Hospital, Edmonton, AB; Vancouver Coastal Health, Vancouver Community Audiology Centre, Vancouver, BC; and Fraser Health Authority, Langley Public Health, Langley, BC. Other sites from the Provinces of Manitoba and Newfoundland and Labrador have recently joined this group.

Co-Authors, Marlene Bagatto and Andrew Johnson, contributed significantly to this project. Marlene, your commitment to both your PhD work and this project was apparent. You believed in the importance of the work and in our ability to co-produce it. Your perseverance and dedication to research in the area of pediatric audiology is exceptional. Andrew, your contributions in the areas of evidence-based practice, research design, and statistics are gratefully acknowledged. Your mentorship and guidance are respectfully appreciated.

Fellow Students, Marlene Bagatto, Jeff Crukley, Stella Ng, Laya Poost-Foroosh, we believed that we could do it, and acquired the capacity to do it…. even when we may not have thought it at the beginning of the journey. Thank you for making this journey with me and thank you for letting me lean on you when I was overwhelmed. Sharon Culliton, I've enjoyed our growing friendship. Ryan DeForge, thank you for your discussions about the field of knowledge translation over the last 5 years. Your commitment and desire to contribute to the science of knowledge translation is unmatched by any student I know.

Child Amplification Laboratory Colleagues and NCA Colleagues, Danielle Glista, as an experienced PhD 'grad', thank you for your advice and encouragement over the last few years. I look forward to our research collaborations. I wish to gratefully acknowledge the contributions of Kelley Keene to this work. To my National Centre for Audiology colleagues, thank you for your never-ending support of this work.

To my friends, I thank you. To my network of friends made in high school many years ago and who are all still close in friendship even though miles apart; thank you for being cheerleaders during my PhD journey. You believed that an "old dog" could learn a thing or two. To my newer friends, Lori Minler, Susan Barta, and the Women's Circle of Trinity United Church, thank you for believing, encouraging and reminding me to sometimes 'be in the present'.

I wish to thank both my mother, Donna Murray, and my mother-in-law, Colleen Moodie, for their unending love and support. They are role models for all women who aspire to 'do it all'.

Uncle Charlie and Aunt Marie, thank you for your continued support and love.

To my sisters: "there were never such devoted sisters." Thank you.

To my brother-in-laws sister-in-laws, nieces, and nephews, thank you for believing in me, for encouraging me during late-night phone calls, and for watching our children when we needed you to.

To our children, Maija (Ryan), Shane Jr. (Kelly), Kenny and Colleen. You are wonderful children and I am proud of you every day. Thank you for believing in me as a mother and as a student. Thank you for telling me (sometimes daily) that you believed that I could do this. Thank you for putting up with my endless need to work all-of-the-time and not always being with you when you wanted me to. I am so blessed to have all of you in my life. To my grandchildren, Ava, Colin, Brynn and Maggie: you are loved. Thank you for making me take breaks from the unending work and filling my days with laughter, hugs and chocolate-chip muffins.

To my husband Shane, thank you for being beside me throughout this journey. Thank you for holding me up and pushing me forward on days when I was tired. Thank you for tolerating my rising at 3 a.m. to work and write; for listening to my insecurities with compassion; and sharing my success with joy. I could not have done this without you.

To the family members I love who passed away during the last 4.5 years, Kenneth Moodie, Michael Moodie and Charles Murray, I know that you are celebrating this achievement with me. I miss you.

Funding Acknowledgement

This work was supported with funding by the Canadian Institutes of Health Research [Sheila Moodie: 200710CGD-188113-171346, Marlene Bagatto: 200811CGV-204713-174463 and Anita Kothari: 200809MSH-191085-56093]. This work has also been supported by the Ontario Research Fund, Early Researcher Award to Susan Scollie, Starkey Laboratories, Inc. and The Masonic Foundation of Ontario, Help-2-Hear Project.

Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1

1 Background Information

The context for this project is pediatric audiology practice in Canada. The practice gaps defined in the early stages of this research and the subsequent work to address the gaps are relevant to pediatric audiology worldwide.

The Desired Sensation Level (DSL) Method for hearing aid selection and fitting in infants and young children was developed in the Child Amplification Laboratory at the University of Western Ontario. It is a systematic, science-based approach to pediatric hearing instrument fitting that ensures audibility of amplified speech by accounting for factors that are uniquely associated with the provision of amplification to infants and young children who have hearing loss (Seewald, Moodie, Scollie, & Bagatto, 2005). Within the DSL Method, the hearing aid fitting process is comprised of four sequential stages: (1) assessment of hearing for the purposes of hearing aid fitting; (2) hearing aid selection and fitting to ensure speech is audible, comfortably loud and loud sounds are not too loud; (3) verification of hearing aid performance to ensure speech is audible, comfortable and safe for the individual; and (4) evaluation of the impact of the hearing aid for everyday listening situations. In North America, the DSL Method is used by approximately 90% of audiologists who work with infants and young children (Moodie, Rall et al., 2011). It is included as the preferred method for fitting hearing aids in many guidelines for the provision of amplification for infants and young children (Bagatto, Scollie, Hyde, & Seewald, 2010; Bentler et al., 2004; College of Audiologists and Speech Language Pathologists of Ontario [CASLPO], 2002; Modernising Children's Hearing Aid Services Programme, 2007).

In 2008, our research team invited 25 audiologists from across Canada to London, Ontario to collaborate with the Child Amplification Laboratory researchers as members of The Network of Pediatric Audiologists of Canada and work with us to identify problems / gaps in knowledge and/or audiological practice that impact children with hearing loss and their families. During the one and a half day meeting, the pediatric

audiologists discussed the challenges to implementing evidence into clinical practice. The audiologists reached consensus that a gap existed in clinical practice (and the DSL Method) in the fourth stage of the hearing aid fitting process: outcome evaluation of the impact of the hearing aid fitting for young children who wear hearing aids. More specifically, the problem identified was the lack of audiologist-administered outcome measures to evaluate the auditory development and performance of children with permanent childhood hearing impairment (PCHI) aged birth to six years who wear hearing aids. The audiologists agreed to participate in my research and to comprise The Network of Pediatric Audiologists of Canada, with a specific focus on the development of a guideline for hearing aid outcome evaluation for young children. The Network and researchers agreed as a group that the knowledge-to-action (KTA) process described by Graham and colleagues (2006) would facilitate the creation and clinical application of the new guideline under development. This dissertation document describes the journey taken to co-develop and tailor the evidence to promote its clinical uptake. My thesis work focused on interacting with The Network of Pediatric Audiologists of Canada to facilitate the creation and application of the knowledge. Marlene Bagatto, another PhD student in the Health & Rehabilitation Sciences program at The University of Western Ontario focused her dissertation work on the development and evaluation of the clinical process and functional outcome measurement tools included within the guideline. Her work will not be covered in detail within this dissertation. The interested reader is directed to a special issue of Trends in Amplification that includes four articles that describe the project in detail (Bagatto, Moodie, Malendrino et al., 2011; Bagatto, Moodie, Seewald, Bartlett, & Scollie, 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011).

Figure 1-1 provides a schematic that summarizes the two PhD projects and how the KTA framework and specifically three components of the application cycle are utilized in each project during the knowledge creation process.

Current Project: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of the UWO PedAMP

Concurrent Project: Development and evaluation of outcome evaluation tools for pediatric audiology

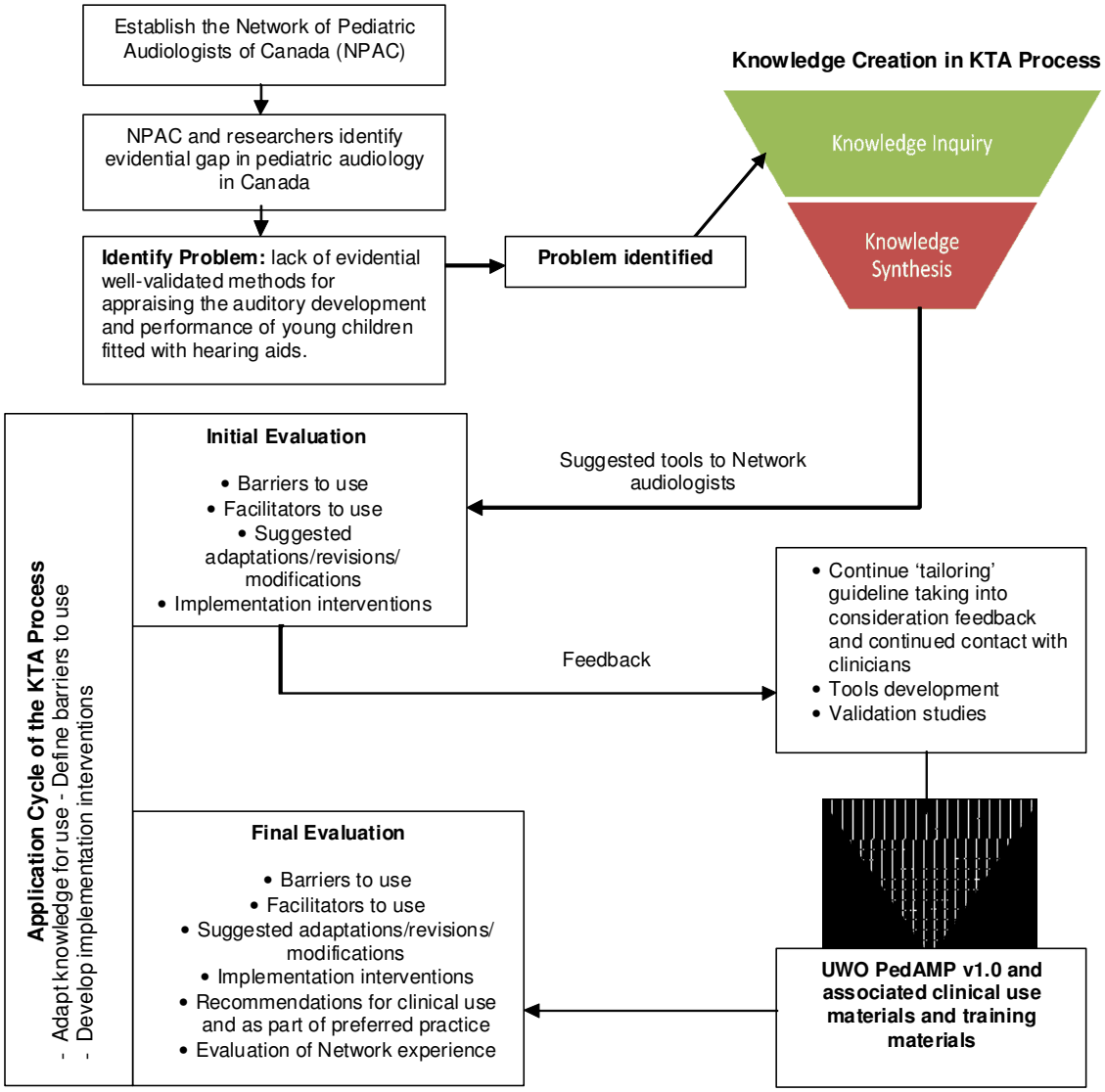


Figure 1-1: Flowchart illustrating the two PhD projects that occurred concurrently resulting in the development of The UWO PedAMP v1.0.

As stated earlier, The Network of Pediatric Audiologists of Canada and Child Amplification Laboratory researchers reached consensus that a gap existed in clinical practice (and the DSL Method) in the area of outcome evaluation of aided performance for young children who wear hearing aids. The pediatric audiologists provided a list of approximately 23 different evaluation tools that they knew about and/or had used, frequently unsuccessfully, in clinical practice as outcome tools. The researchers then conducted an inquiry and synthesis of existing knowledge in the area of outcome evaluation tools that could be administered by the pediatric audiologist in most clinical practice settings when working with young children aged birth to 6 years of age. The researchers also started the development of clinical process outcome measures that could be used as part of the guideline to ensure an appropriate hearing aid fitting had been achieved at the completion of the hearing aid verification stage (prior to undertaking outcome measures), and to facilitate systematic evaluation of program-level outcome measures (part of the KTA application cycle). As shown in Figure 1-1, the next stage of the project was to have the Network audiologists evaluate: (a) the suggested outcome measurement tools to be included in the guideline and provide feedback on the tools, score sheets, instruction materials, etc., and (b) to provide information relative to adaptations that might be necessary for the context in which they worked; barriers and facilitators to implementation, and provide information regarding materials that might be developed (training materials, administrative-level materials) which would facilitate clinical uptake of the measures. This information was used, consistent with the KTA process, to 'tailor' the final knowledge product to facilitate clinical uptake. The research team used the feedback provided by the Network audiologists to improve the clinical outcome tools and develop appropriate training materials (implementation interventions). The final knowledge product, The University of Western Ontario's Pediatric Audiological Monitoring Protocol (UWO PedAMP) v1.0 was then sent to the Network audiologists along with the training materials for a final evaluation. The integrated articles included in this dissertation provide the background information for the work, questionnaires, and feedback results from the Network of Pediatric Audiologists of Canada as they collaborated with us during the development of The UWO PedAMP.

1.1 References

Bagatto, M. P., Moodie, S. T., Malandrino, A. C., Richert, F. M., Clench, D. A., & Scollie, S. D. (2011). The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP). *Trends in Amplification, 15*(1), 57-76. doi: 10.1177/1084713811420304

Bagatto, M. P., Moodie, S. T., Seewald, R. C., Bartlett, D. J., & Scollie, S. D. (2011). A critical review of audiological outcome measures for infants and children. *Trends in Amplification, 15*(1), 23-33. doi: 10.1177/1084713811412056

Bagatto, M., Scollie, S., Hyde, M., & Seewald, R. (2010). Protocol for the provision of amplification within the Ontario Infant Hearing Program. *International Journal of Audiology, 49*, S70-S79. doi: 10.3109/14992020903080751

Bentler, R., Eiten, L., Gabbard, S., Grimes, A., DeConde Johnson, C., Moodie, S., … Tharpe, A. M. (2004). Pediatric amplification guideline. *Audiology Today, 16*(2), 46-53. Retrived from http://www.audiology.org/resources/audiologytoday/

College of Audiologists and Speech-Language Pathologists of Ontario. (2002). *Preferred practice guideline for the prescription of hearing aids for children.* Toronto, ON: College of Audiologists and Speech-Language Pathologists of Ontario.

Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map? *The Journal of Continuing Education in the Health Professions, 26*, 13-24. doi: 10.1002/chp.47

Modernising Children's Hearing Aid Services (2007). Guidance on the use of real ear measurement to verify the fitting of digital signal processing hearing aids. Retrieved from: http://www.thebsa.org.uk/docs/RecPro/REM.pdf.

Moodie, S. T., Bagatto, M. P., Miller, L. T., Kothari, A., Seewald, R. C., & Scollie, S. D. (2011). An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). *Trends in Amplification, 15*(1), 34-56. doi: 10.1177/1084713811417634

Moodie, S. T., Kothari, A., Bagatto, M. P., Seewald, R. C., Miller, L., & Scollie, S. D. (2011). Knowledge translation in audiology: Promoting the clinical application of best evidence. *Trends in Amplification, 15*(1), 5-22. doi: 10.1177/1084713811420740

Moodie, S., Rall, E., Lindley, G., Eiten, L., Davidson L., Littman, T., & Gordey, D. *Survey of Best Practices: Pediatric Hearing Aid Fitting.* Learning module presentation at The American Academy of Audiology: AudiologyNOW! Conference, Chicago, IL, April, 2011.

Seewald, R. C., Moodie, S. T., Scollie, S. D., & Bagatto, M. P. (2005). The DSL Method for pediatric hearing instrument fitting: Historical perspective and current issues. *Trends in Amplification, 9*(4), 145-157. doi: 10.1177/108471380500900402

Chapter 2

2 A survey of factors influencing implementation of evidence-based practice among Canadian audiologists

The fundamentals of evidence-based practice (EBP) can be traced to ancient times with both the Hippocratic Oath and the Oath of Maimonides adamantly stating that clinicians have a moral obligation to use knowledge in the treatment of their patients (Goodman, 2003).

Since the 1970's, the impetus for EBP has grown out of widespread concern that the gap between research evidence and clinical practice has affected the quality and efficiency of health care received by the public (Claridge & Fabian, 2005; Levin, 2001; Spring, 2007). Closing the gap meant knowing: (1) which interventions worked; (2) how well they worked; and (3) how to get this information in the hands of clinical practitioners. Archibald Cochrane (1909-1988), an epidemiologist, posited that randomized clinical trials could close the gap by identifying the most useful, valid and scientific interventions. Cochrane pointed out that health services would be greatly enhanced if medicine organized a critical summary, by specialty or subspecialty, adapted periodically, of all relevant randomized controlled trials (as cited in Levin, 2001). This statement motivated Iain Chalmers, an obstetrician, to coordinate a systematic review of all perinatal medicine randomized control trials (RCTs) from 1940 to 1984 in order to provide a critical summary of the available scientific evidence for use by physicians and women using maternal services. This first evidence-based systematic review was published in 1985 and became almost immediately outdated. In 1993, Chalmers along with 70 other people announced the formation of the Cochrane Collaboration. The mandate of the Cochrane Collaboration is to independently prepare, maintain, and disseminate systematic reviews and meta-analyses to help people make evidence-based decisions about health care interventions (Grimshaw, Santesso, Cumpston, Mayhew, & McGowan, 2006). Currently, there are over 4,600 Cochrane Reviews available in The Cochrane Library with hundreds of new reviews and protocols added every year (http://www.cochrane.org).

In the early 1980s, a number of faculty members at McMaster University, in Hamilton, Ontario, Canada began to focus their efforts on methods for evidence-based professional practice in health care based on their conceptualization of EBP. Sackett and colleagues, (1996, p.71) noted that EBP is "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical experience with the best available external clinical evidence from systematic research." The desired outcome of the concerted efforts towards EBP undertaken by groups such as the Cochrane Collaboration, and McMaster University researchers, is to increase the number of patients who receive treatments of proven effectiveness.

2.1 Evidence-based practice in audiology

Like most health professions, audiology has been working on incorporating an evidence-based approach to practice and learning. The American Academy of Audiology (AAA) has included EBP as one of its core values and defines it as: "To practice according to best clinical practices for making decisions about the diagnosis, treatment, and management of persons with hearing and balance disorders, based on the integration of individual clinical expertise and best available research evidence." (American Academy of Audiology, n.d.). The Canadian Association of Speech-Language Pathologists and Audiologists (CASLPA) and The Canadian Academy of Audiology (CAA) also promote EBP as imperative to clinical practice.

Unfortunately evaluations of clinical practice in audiology indicate that there is a gap between the evidential knowledge base and what is done in clinical practice (Bess, 2000; Kirkwood, 2010; Kochkin, 2011; Kochkin et al., 2010; Lindley, 2006; Mueller, 2003; Mueller & Picou, 2010; Strom, 2006, 2009). For example, real-ear probe-microphone verification of the electroacoustic performance of hearing aids and subsequent validation of the hearing aid fitting are recommended by best practice guidelines for adults and for children (Bagatto, Scollie, Hyde, & Seewald, 2010; Bentler et al., 2004; College of Audiologists and Speech Language Pathologists of Ontario [CASLPO], 2000, 2002; King, 2010; Modernising Children's Hearing Aid Services Programme, 2007; Valente et al., 2006). In clinical practice however, studies have shown that more than half of adult

hearing aid fittings are not verified with real-ear probe-microphone measures of hearing aid performance (Lindley, 2006; Kochkin et al., 2010; Mueller & Picou, 2010; Strom, 2006, 2009). Kochkin and colleagues (2010) and Kochkin (2011) reported that 64% of hearing aids fit in the U.S. between 2008 and early 2009 were not verified using real-ear probe-microphone measures and were not evaluated with objective or subjective validation measures. By not including verification and validation of hearing aid performance in the hearing aid fitting process, hearing healthcare providers are not only being noncompliant with the recommended clinical practice guidelines, they may be increasing: (a) the level of reported dissatisfaction of individuals who purchase hearing aids (Henson & Beck, 2008; Kochkin et al., 2010); (b) the number of return visits required by the end user to achieve a satisfactory fit; and (c) the number of hours per year they are spending as practitioners trying to achieve a satisfactory fit (Kochkin, 2011). In fact, Kochkin (2011) reports that based on the nearly 2.7 million hearing aids fit in the U.S. in 2010, the systematic evaluation of hearing aid performance using real-ear probe-microphone verification and evidence-based validation procedures could reduce return patient visits for refitting by a total of 521,779 visits, and reduce by 391,334 hours in a single year practitioners are spending on these visits (para. 9 and 10). The challenge currently facing the practice of audiology is, how do we address the evidential knowledge-to-clinical-action gaps and improve practitioner adherence to best practice guidelines?

2.2 Factors that influence the implementation of evidence-based practice

The publication of systematic reviews and development of clinical practice guidelines (CPGs) make some aspects of the evidence-based practice process easier; however implementing change can still be challenging. Analyses indicate that factors which may influence the development and use of evidence-based practice by healthcare professionals arise at many different levels: (a) at the level of the guideline, (b) the individual practitioner, (c) the organization, (d) the wider practice environment; and (e) at the level of the patient (Aarons, 2006; Bhattacharyya, Reeves, & Zwarenstein, 2009; Brown, Tseng, Casey, McDonald, & Lyons, 2011; Carlson & Plonczynski, 2008; Cummings,

Estabrooks, Midodzi, Wallin, & Hayduk, 2007; Curtin & Jaramazovic, 2001; Damschroder et al., 2009; Davis & Taylor-Vaisey, 1997; Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003; Estabrooks, Squires, Cummings, Birdsell, & Norton, 2009; Gerrish, Ashworth, Lacey, & Bailey, 2008; Gerrish et al., 2007; Gerrish & Glayton, 2004; Glasgow & Emmons, 2007; Green, 2001; Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004; Grol, Bosch, Hulscher, Eccles, & Wensing, 2007; Grol & Grimshaw, 2003; Grol & Wensing, 2004; Grol & Wensing, 2005; Heiwe et al., 2011; Hutchinson & Johnston, 2004; Iles & Davidson, 2006; Ismail & Bader, 2004; Kajermo et al., 2010; Kryworuchko, Stacey, Bai, & Graham, 2009; Légaré, 2009; Lemieux-Charles & Barnsley, 2004; Masso & McCarthy, 2009; McCluskey, 2003; McCormack et al., 2002; Metcalfe et al. 2001; Michael & John, 2003; Moodie et al., 2011; Mullins, 2005; Pagoto et al., 2007; Rosenheck, 2001; Rycroft-Malone, 2004; Salls, Dolhi, Silverman, & Hansen, 2009; Thompson et al., 2008; Veldhuizen et al., 2007; Yadav & Fealy, 2011; Zipoli & Kennedy, 2005).

Table 2-1 provides a list of these factors (Moodie, Kothari et al., 2011). Chapter 3 of this dissertation (Moodie, Kothari et al., 2011) provides additional details.

Table 2-1: Characteristics that influence the development and use of evidence in clinical practice.

Characteristics of the _____ that influences adoption and implementation

Guideline	Practitioner	Context	Broader System
relative advantage or utility	time/"busyness"	workplace structure	nature of financial arrangements
compatibility/ complexity	lack of authority to change practice	organizational agenda	support for change
costs	lack of support from organization for practice change	available resources/lack of access to journals	regulation of health professionals
flexibility/adaptability	perception of legitimacy of the source of the guideline	staff capacity	financial stability
involvement	perception of quality/validity	staff "turn-over"	pressure from other heatlh professionals or public
form/physical properties/presentation	lack of evidence/conflicting evidence	organization of care processes	
trialability/reversibility	habits/customs/chosen non-compliance	efficiency of the system	
visibility/observability	beliefs of peers	social capital of practitioners and organization	
centrality	social norms	level of inservice/continuing education opportunities	
pervasiveness/scope/ impact	attitude about guidelines	policy/procedure documentation	
magnitude/ disruptiveness/ radicalness	lack of outcome expectancy	leadership/good communication	
duration	lack of self-efficacy	relationships: practitioners and practitioners to managers	
collective action	lack of motivation		
	lack of awareness of existence of guideline		

Reprinted from "Knowledge translation in audiology: Promoting the clinical application of best evidence" by S. T. Moodie, A. Kothari, M. P. Bagatto, R. C. Seewald, L. T. Miller, and S. D. Scollie (2011). *Trends in Amplification, 15*(1), 5-22. Copyright by SAGE Publications, Inc. Reprinted with permission.

A recent systematic review assessed more than 60 studies using the Barriers to Research Utilization Scale (BARRIERS scale; Funk, Champagne, Wiese, & Tornquist, 1991). The review found that the barriers to research use reported by nurses have remained constant from 1991 to 2009, and across geographic locations (Kajermo et al., 2010). The most

frequently-cited barriers to using research in clinical practice were time on the job to implement new ideas, and time to read research.

In 2005, The American Speech-Hearing Association (ASHA) conducted a knowledge-attitudes-practice survey on evidence-based practice (Mullins, 2005). In this survey audiologists and speech-language pathologists were invited to examine a list of potential barriers to their ability to engage in evidence-based practice, and characterize each as a major, moderate, minor barrier, or not a barrier. Similar to the factors presented in Table 2-1, and recent surveys of other allied health professionals (Brown et al., 2011; Heiwe et al., 2011), results indicated that moderate to major barriers to EBP included: limited access to journals and continuing education; interpretation of research; lack of consistent evidence; lack of organizational support; and insufficient time.

In the present study we build on the Mullins (2005) research by acquiring an understanding of the knowledge used by Canadian audiologists in practice, the barriers to achieving evidence-based practice both at individual and work-environment levels, and facilitators to changing practice based on best evidence. We also examine the self-reported ability of Canadian audiologists to find, review and use research evidence in their practice.

2.3 The study

2.3.1 Aim

The aim of the study was to survey Canadian audiologists to determine the important factors that influence their implementation of evidence-based practice.

2.3.2 Methods

This study was reviewed and approved by the research ethics board at the University of Western Ontario. A participant letter of information giving details of the study accompanied the online questionnaire. Consent to participate was assumed on the basis of the completed online questionnaire.

2.3.3 Participants

An email invitation to participate was sent to members of the Canadian Academy of Audiology (CAA) and Canadian Association of Speech-Language Pathologists and Audiologists (CASLPA). The email contained a link to the Internet-based questionnaire.

2.3.4 Instrument

Survey data were collected using the Developing Evidence-Based Practice (DEBP) Questionnaire (Gerrish et al., 2007; Gerrish et al., 2008). The online survey tool SurveyMonkey™ (www.surveymonkey.com) was used to collect respondent results. The DEBP questionnaire has previously been demonstrated to have acceptable reliability and validity (Gerrish et al., 2007; Gerrish et al., 2008), with a Cronbach's alpha of 0.874 suggesting that the items in the DEBP questionnaire are highly inter-correlated (and thus demonstrate good internal consistency). Although originally developed for use with the nursing profession, the choice of the DEBP questionnaire for this survey was based on its ability to measure constructs of interest for audiology, including factors associated with the use of evidence-based practice knowledge, and barriers/facilitators to changing practice based on the best available evidence. The DEBP questionnaire is comprised of several sections. Section 1 consists of 22 items that measure sources of knowledge used in practice. Each item in this section was scored on a 5-point Likert scale from 1 (never) to 5 (always). Section 2 (ten items) and Section 3 (five items) measure variables related to barriers to finding and reviewing evidence and barriers to changing practice. Section 4 (four items) examines facilitators to changing practice based on evidence. For the purposes of this audiology-based survey, the items in sections 2, 3 and 4 were scored on a 4-point Likert scale from 1 (strongly disagree) to 4 (strongly agree). The rationale for modifying these sections to a 4-point from the original 5-point Likert scale (which includes a neutral point) was to force respondents to make a choice (Portney & Watkins, 2000). It was felt that the items in these sections were constructed in such a way that audiologists *should* be able to thoughtfully provide a precise agreement rating. In addition, because this was one of the first surveys to closely examine barriers and facilitators to evidence-based practice in Canadian audiology we felt it important to

obtain agreement on the identity of these barriers /facilitators to practice change. Eliminating the neutral category could assist us in future development of strategies and interventions to promote evidence-based practice by Canadian audiologists. Section 5 consists of eight items asking audiologists to rate themselves on skills of finding, reviewing and using evidence in practice. Each item was scored on a 5-point Likert scale ranging from 1 (complete novice) to 5 (expert). The questionnaire wording was modified so that the terms of reference related to audiologists and audiology practice contexts rather than to nurses and nursing practice contexts. It was also augmented with educational and job-related demographic questions.

2.3.5 Data Analysis

One hundred and twenty-two audiologists (122) answered the demographic questions and Section 1 of the survey which examined sources of knowledge used in practice. All 4 sections of the online DEBP questionnaire were completed by 118 audiologists. The data were analyzed using SPSS (version 16).

2.4 Results

2.4.1 Participants

Respondents were primarily female (80%) ranging in age from 25 to 65 years of age, with an average age of approximately 43 years. The majority of respondents (54%) resided in the province of Ontario, followed by British Columbia (16%) and Alberta (10%). There were no respondents to the online survey from Saskatchewan, Prince Edward Island, Northwest Territories, Yukon or Nunavut. Most audiologists (75%) had Masters level graduate degrees with an additional 22% reporting having (or working towards) a doctor of audiology (AuD) degree. Approximately 86% of respondents classified themselves as clinical audiologists. The remaining respondents classified themselves as: administrator or clinician-manager; consultant; industry representative; and academic or researcher at a university. Forty-five percent (45%) of audiologists described their work setting as private practice. The second most frequently-cited work setting was hospital (30%). The remaining audiologists worked in public health (9%);

university (7%); school/education (4%); industry (2%); children's treatment centre (2%); long-term care and adult rehabilitation centre (1%). Most audiologists (77%) reported working full time. The primary caseload of respondents was 65 years of age and older (41%). Individual's aged 18 to 64 years accounted for 31% of their caseload. Individuals aged 6 to 17 years of age comprised the smallest percentage of the caseload at 7%, and children aged birth to 5 years comprised 21% of the reported case load. Virtually all (99%) of the audiologists reported having access to the internet at work.

2.4.2 Factors influencing evidence-based practice

Prior to examining the overall survey results, a one-way analysis of variance (ANOVA) was conducted to compare the four audiology practice caseload groups (birth to 5 years; 6 to 17 years; 18 to 64 years; and 65 years and older) self-selected for inclusion by participants for the 51 DEBP questionnaire items. The level of significance [alpha (α)] for the ANOVA analysis was set at a criterion of 0.01 ($p < .01$). This level of significance was selected due to the small sample size (n=118) and relatively large number of questionnaire items (51). As well, we wanted to avoid a Type I error (saying the groups differed; when in fact they did not) [Portney & Watkins, 2000]. Results indicated that for the 51 questionnaire items, significant differences existed across the audiology caseloads for only one item. There was a statistically significant difference between knowledge used in practice based on local policy and protocols and patient caseload ($F(3,115) = 4.009$, $p = .009$). Tukey post-hoc comparisons however revealed no significant differences between the four caseloads and the frequency with which they reported using knowledge based on local policy and protocols.

An independent sample *t*-test analysis was undertaken to determine whether or not responses on the DEBP questionnaire were significantly different among audiologists practicing with a professional-level Doctoral degree (AuD) as compared with audiologists with a Masters-level degree (e.g. MSc, MClSc). Alpha (α) for this independent-groups *t*-test was also set at 0.01 ($p < .01$). Of the 51 DEBP questionnaire items, significant differences existed for only one item. Audiologists with AuD degrees ($M = 3.95$, $SD = .65$) rated their current competency at using the internet to search for

information significantly higher than audiologists with Masters-level degree certification (M = 3.50, SD = .79), (t(98) = 2.751, p = .009).

Overall, the results indicated that the respondents to the survey of factors influencing implementation of evidence-based practice among Canadian audiologists were generally a homogenous group, and therefore results were examined across the sample as a whole. Analyses of the survey results are presented below, in several subsections: (1) sources of knowledge used in practice; (2) barriers to finding and reviewing research reports and organizational information; (3) barriers to changing practice in Canadian audiology based on evidence; (4) facilitators to changing practice in Canadian audiology; and (5) self-report ratings of skills in finding and reviewing evidence and effecting practice change.

2.4.3 Sources of knowledge used in practice

Knowledge-based factors influencing EBP by Canadian audiologists are shown in Table 2-2. The most frequently agreed upon primary sources of knowledge for Canadian audiologists are those obtained from interacting with each patient/client as an individual, the experiential knowledge audiologists acquire over time, information from their training and continued education opportunities, and knowledge acquired from published research.

Table 2-2: Sources of knowledge used in Canadian audiology practice.

Item	Mean score (SD)	Rank
information that I learn about each patient/client as an individual	4.6 (0.67)	1
my personal experience of caring for patients/clients over time	4.2 (0.75)	2
information I get from attending in-service training conferences	4.1 (0.58)	3
information I learned from my training	4.0 (0.86)	4
new research that I learn about	3.8 (0.68)	5
information my fellow audiologists share	3.5 (0.73)	6
information more experienced clinical audiologists share	3.5 (0.88)	7
information I get from local policy and protocols	3.5 (0.97)	8
articles published in audiology journals	3.5 (0.95)	9
what has worked for me for years	3.5 (0.87)	10
information I get from national policy initiatives/guidelines	3.4 (0.96)	11
my intuition about what seems to be ‘right’ for the patient/client	3.4 (0.97)	12
information in textbooks	3.3 (0.87)	13
information that I learn about from manufacturers representatives	3.3 (0.84)	14
information I get from product literature	3.1 (0.88)	15
articles published in other research journals	3.0 (0.96)	16
articles published in non-peer reviewed journals	2.9 (0.85)	17
information that I get from the internet	2.9 (0.83)	18
the way that I have always done it	2.9 (0.74)	19
what doctors discuss with me	2.7 (0.96)	20
information I get from audit reports	2.2 (1.09)	21
Information that I get from media (TV)	1.5 (0.67)	22

Note: 5-point Likert scale: 1 (never) to 5 (always).

The most frequently agreed upon sources of knowledge that Canadian audiologists do *not* primarily use in practice are: information obtained from media (TV) and the internet, information from audit reports, and information obtained from discussions with physicians.

2.4.4 Barriers to finding and reviewing research reports and organizational information such as policies, guidelines, and clinical protocols

As Table 2-3 shows, the greatest perceived barriers for Canadian audiologists to finding and reviewing research reports and organizational information are related to time. The majority of respondents (82%) indicated that they knew how to find appropriate research reports, with 64% indicating that they feel confident in judging the quality of these reports. One third of audiologists (36%) indicated that they do not feel confident in judging the quality of research reports, and 20% find it difficult to identify the implications of research findings for their practice.

Table 2-3: Barriers to finding and reviewing research reports and organizational information.

Item	Mean score (SD)	Rank
I do not have sufficient time to find research reports	2.7 (0.79)	1
I do not have sufficient time to find organization information	2.4 (0.70)	2
Research reports are not easy to find	2.2 (0.70)	3
I do not feel confident in judging the quality of research reports	2.2 (0.78)	4
I find it difficult to identify the implications of research findings for my own practice	2.0 (0.63)	5
Organizational information is not easy to find	2.0 (0.65)	6
I find it difficult to understand research reports	1.9 (0.70)	7
I find it difficult to identify the implications of organizational information for my own practice	1.9 (0.60)	8
I do not know how to find appropriate research reports	1.8 (0.74)	9
I do not know how to find organizational information	1.7 (0.66)	10

Note: 4-point Likert scale: 1 (disagree strongly) to 4 (agree strongly).

2.4.5 Barriers to changing evidence-based practice in Canadian audiology based on 'best evidence'

Approximately one half of all respondents specified that the greatest barriers to changing practice on the basis of 'best evidence' were insufficient time at work to make practice changes (56%) and insufficient financial resources to change practice (49%). In addition 32% of respondents indicated that there were insufficient equipment resources in place to change practice. Table 2-4 presents the mean, standard deviation (SD) and rank order for barriers to changing practice based on 'best evidence'.

Table 2-4: Barriers to changing evidence-based practice based on 'best evidence'.

Item	Mean score (SD)	Rank
there is insufficient time at work to implement changes in practice	2.6 (0.67)	1
there are insufficient financial resources to change practice	2.5 (0.73)	2
there are insufficient equipment resources to change practice	2.2 (0.67)	3
I feel that our practice lacks a leader with knowledge in 'best evidence' to change practice	2.2 (0.82)	4
I lack the authority in the workplace to change practice	2.0 (0.73)	5
the culture of my team is not receptive to changing practice	1.9 (0.61)	6
I do not feel confident about beginning to change my practice	1.9 (0.56)	7

Note: 4-point Likert scale: 1 (disagree strongly) to 4 (agree strongly).

Respondents were invited in an open-item response format to provide any additional barriers they perceived to the provision of evidence-based care in their practice. Table 2-5 provides a summary of the most frequently listed barriers which include time, funding for service provision and cost/access to appropriate audiology research journals.

Table 2-5: Additional self-reported barriers to finding, reviewing and/or using evidence in Canadian audiology practice.

- I work alone, no colleagues, no library access,
- with the firewall at work, I am unable to set up the proxy to access journal articles
- many funding sources pay for procedures that have historically been funded and are not easy to change if the evidence changes.
- non-audiologist managers
- lack of Government funding support to make changes and increased workload of government paperwork
- long-term evidence for "best" practices and retrospective study of previously indicated best practice procedures to determine the validity of the so indicated best practice statements
- a lack of sufficient or appropriate evidence in the areas in which I "need" these types of research-based "answers" (e.g. auditory processing, auditory dysynchrony)
- not enough audiologists doing the research.
- funding for more clinical audiologists
- audiology as a profession seems to be slow in adopting evidence based practices supported in our literature and our degree programs seem slow in teaching those changes in practice
- most audiologists here (there are a number of us) are very supportive of changing practice based on current evidence, however there are several on the team who are quite resistant and threatened, and feel that by updating practice that it means that they've been doing it wrong all those years. Also … it's hard to change habit - even if you know better somehow you just keep doing things the same old way

(not in rank order).

2.4.6 Facilitators to changing evidence-based practice in Canadian audiology based on 'best evidence'.

As a profession in Canada, most audiologists agreed (> 90%) that audiologists with whom they work and the wider audiological community were supportive of practice change based on 'best evidence'. The majority also agreed (75% to 77% respectively) that administrators and managers/supervisors were supportive of evidence-based practice change.

In an open-item response format, respondents were asked to identify three factors that would facilitate the provision of evidence-based care within their practice setting. Table 2-6 provides a summary of the most frequently listed factors. Sufficient work-related release time to read and learn, free online access to journals/audiology publications, increased funding for continuing education opportunities, relevant research and dissemination in appropriate clinical formats were all seen as factors that would facilitate uptake of evidence into application in clinical practice.

Table 2-6: Self-reported factors that Canadian audiologists believe would facilitate them in providing evidence-based care.

- **Time**
  - to find, review and read research / articles at work
  - to discuss /plan with other team members or colleagues how to implement changes in practice based on best evidence
  - to take courses
  - for meetings
- **Financial support**
  - to fund the purchase of appropriate equipment that can often be quite expensive
  - from employers to attend conferences/training/continuing education opportunities/upgrade credentials (e.g. to AuD)
  - employer to fund access to appropriate peer-reviewed audiology journals
- **Improved and increase in audiology research and clinical practice guidelines**
  - articles in audiology journals that show the cost-benefit of implementing evidence-based practice
  - replication of research articles that support similar conclusions
  - better written articles that are more understandable to clinicians
  - more clinical practice guidelines for audiology
- **Web-based resources**
  - summary reviews of research articles, written in language clinicians can understand
  - better dissemination of research
  - web-based courses
  - articles and guidelines in a web-based clearing house so clinicians know where to go to look for evidence
- **Improved research and guideline information audiologists can bring to Managers**
  - manager-ready summaries presenting succinct arguments for changes in practice with defensible evidence and appropriate reference list
- **Increase the number of audiologists in Canada**
- **Improve professional autonomy and increased payment by government of patient-related fees**

(not in rank order)

2.4.7 Skills in finding and reviewing evidence and effecting practice change

As shown in Table 2-7, most Canadian audiologists rated themselves as competent for seven out of the eight items included in the skills section of the DEBP questionnaire. Respondents rated themselves as quite skilled as opposed to competent for using

organizational information to change practice. Twenty-two to thirty percent of Canadian audiologists characterized themselves as novices in finding and reviewing research evidence, or using research evidence to change clinical practice.

Table 2-7: Skills in finding, reviewing and using different sources of evidence. Percent rating for each category.

Item	Complete Novice (%)	Novice (%)	Quite Skilled (%)	Competent (%)	Expert (%)
Finding evidence					
finding research 'evidence'	2%	29%	23%	37%	10%
finding organizational information	1%	24%	30%	41%	4%
using the library to locate information	2%	22%	32%	34%	11%
using the internet to search for information	1%	23%	30%	41%	5%
Reviewing research evidence					
reviewing research evidence	1%	23%	30%	41%	5%
reviewing organizational information	1%	23%	32%	42%	2%
Using research evidence					
using research evidence to change practice	1%	30%	31%	33%	5%
using organizational information to change practice	1%	23%	37%	35%	4%

2.5 Discussion

Factors influencing the implementation of EBP have not been well studied among audiologists. This study explored the sources of knowledge that Canadian audiologists use in practice, the barriers and facilitators to implementing evidence to change clinical

practice, and the perceived skill ratings for finding, reviewing and using evidence in practice.

2.5.1 Sources of knowledge used in practice

A comparison of the current study results and those obtained when the DEBP questionnaire was used with nurses (Gerrish et al., 2008) reveals some similarities between the two health professions. The healthcare professionals in both studies rank work-based (*information I learn about each patient as an individual*) and experiential knowledge (*my personal experience of caring for patients over time*) as the highest ranked sources of knowledge used to guide their practice. Two items that differ in ranking for audiologists relative to nurses are *what doctors discuss with me* and *information I get from audit reports*. Both of these items rank in the bottom three sources of practice knowledge used by audiologists but rank much higher for nurses. These similarities and differences across the two health professions are not surprising. Both health professions are patient-focused and each patient brings individuality to the clinical encounter. Accumulated years of explicit and tacit knowledge development facilitate the expeditious acquisition of information from patients. Many respondents to this survey work in private practice settings (45%) and may be less likely to use knowledge in practice based on discussions with doctors. Likewise their use of knowledge in practice will be less influenced by institutional work-related audit reports.

2.5.2 Barriers to finding and reviewing research reports and organizational information such as policies, guidelines, and clinical protocols

The majority of Canadian audiologists (> 80%) report knowing *how* to find research reports and organizational information; understand the reports and can identify the implications of research findings and organizational information for their practice. Approximately two-thirds (64%) agreed that they felt confident in judging the quality of the research reports. No similar studies in audiology could be found; however, the results are similar to those from occupational therapists (OTs) and speech-language pathologists (Salls et al, 2009; Zipoli & Kennedy, 2005). Seventy percent (70%) of OT respondents in

the Salls et al., (2009) study agreed that they were confident in their ability to find relevant research, and 78% agreed that they were confident in their ability to review this literature. The results of the Zipoli and Kennedy (2005) study indicated that 87% of SLP respondents did not perceive knowledge and skills as barriers to evidence-based practice. However, in a recent study examining pediatric occupational therapists' (OTs) research utilization in Australia, the United Kingdom, and Taiwan, 71.6 % of pediatric occupational therapists reported they did not feel capable of evaluating the quality of the research, with the same percentage (71.6%) feeling that the results were not generalizable to their own work setting (Brown et al., 2011). In contrast, 67% of pediatric audiologists (those individuals with patient caseloads in the age range of birth to 5 years) who responded to the current audiology-focused survey reported that they were confident in evaluating the quality of the research reports.

2.5.3 Barriers to changing evidence-based practice in Canadian audiology based on 'best evidence'

Canadian audiologists report that the greatest barriers to changing practice on the basis of 'best evidence' are insufficient time at work to find research or to implement any changes in practice. These results replicate those reported in a systematic review of the barriers to research utilization (BARRIERS) scale (Kajermo et al. 2011). A large percentage (72%) of the studies examined by Kajermo et al. (2011) had more than half of the nurses rating time to read research and time on the job to implement new ideas as a moderate to great barrier to implementation of evidence into practice. More than 90% of the studies consistently rated time to read and time to implement evidence among the top ten barriers (Kajermo et al., 2011). Speech-language-pathologists and occupational therapists also reported that time to read and/or time to implement evidence into practice are the greatest barriers to research utilization (Salls et al., 2009; Zipoli & Kennedy, 2005).

Thompson et al. (2008) studied what nurses meant when they reported 'lack of time' as a barrier to research utilization. They proposed that nurses felt that "being busy" and "not idle" at work was valued and rewarded; while sitting, reading and reflecting (using mental time and cognitive processes) to examine research and understand the

implications of research for their practice during work hours was less valued, and therefore more difficult to do within a constantly changing clinical environment. Audiology practice also values what Thompson et al. (2008) refer to as a "culture of busyness" (pg. 546), which appears to have an impact on research utilization. Respondents to the current survey provided the following subjective statements about lack of time when queried to write about their greatest barriers to the development and clinical implementation of evidence based practice.

- *"…when I am the only audiologist where 3 full time positions are acknowledged to be needed, I constantly have to juggle the "urgent" needs of individual patients with the long term necessity to change practice in accordance with evidence. It is frequently overwhelming."*

- *" Having a life that is meaningful and important to me outside of audiology means that I choose not to devote the time to keeping as up to date in all areas of literature relevant to my practice as I could. … Time spent keeping current is personal and unpaid, and reflects my commitment to my professional integrity. I could make time within my practice time to read, but I can barely keep up with my patients and time spent servicing them seems more important at this point."*

2.5.4 Facilitators to changing evidence-based practice in Canadian audiology based on 'best evidence'

The majority of respondents to this survey indicate that colleagues, managers/supervisors and administrators are all supportive of changing practice based on the best available evidence. Participants identified the following important facilitators to providing evidence-based care: having more "work-time" available to reading literature; having open-access publications and reduced 'fire-walls' at work so that they can access the literature; funding from employers to attend continuing education opportunities; having summaries of important literature available on a website; having improved funding for equipment; and being provided with increased professional autonomy. Their qualitative written responses indicate agreement with the Thompson et al. (2008) paper.

Audiologists in Canada generally state that they have the knowledge, skills and confidence to find, review and evaluate research; they also indicate that they work in practices and with colleagues who are supportive of changing practice. The greatest facilitators to practice change appear to be related to valuing time to read and reflect on research during the work day, reduction of the barriers to obtaining the literature (through access and funding) and improved professional autonomy.

2.5.5 Study limitations

There are several limitations to this study. One of the disadvantages to conducting a survey using web-based methods such as email invites via professional associations to participate in an online survey where data is collected via Survey Monkey (www.surveymonkey.com) is that it is difficult to calculate a response rate. Invitations to participate in this survey were sent to Canadian audiologists registered with CASLPA and CAA. Using information obtained from CASLPA about the number of audiologists registered with their association (~700), a response rate of approximately 17% to the evidence-based practice survey was calculated. A similar study conducted with nurses in the United Kingdom achieved a 42.4% response rate (Gerrish et al., 2008). In their systematic review of the BARRIERS scale, Kajermo et al. (2010) reported response rates for more than 60 studies they reviewed ranging from 9% to 92% with less than one-half achieving a response rate of 60%. Further, the current recruitment strategy may have obtained a biased sample, with participants choosing to complete the survey based on strong positive or negative attitudes toward EBP. Those who did not participate in the study may have had different attitudes about EBP.

The DEBP questionnaire has been shown to be a reliable and valid method for defining factors influencing evidence-based practice in the profession of nursing. It has not been validated for use in the profession of audiology. In addition, the Likert scale for three of the DEBP questionnaire sections was changed from a 5-point to a 4-point scale to force audiologists to agree or disagree with the various item statements. This may have altered the reported validity/reliability of the tool; however, we believe that it provides more decisive information with which to evaluate the factors influencing the clinical

implementation of evidence based practice in Canadian audiology and assists with the development of strategies and interventions to improve research utilization.

Several limitations of the Developing Evidence Based Practice (DEBP) questionnaire were discovered during data analysis and writing of this paper. Time is the greatest barrier to the clinical implementation of evidence-based practice by Canadian audiologists. The DEBP questionnaire does not assist with our deeper understanding of the value of clinical "busyness" or value of reflective learning time in the various contexts in which audiologists work (Thompson et al., 2008). It appears from the subjective responses to the open-ended item request for respondents to list their top three facilitators to practice change that future versions of the DEBP questionnaire might benefit from additions to the list of factors which facilitate the development and clinical implementation of evidence into clinical practice.

Finally, the results of this survey imply that a relationship exists between the perceptions of barriers and facilitators to research utilization and actual evidence use. As reported in Kajermo et al. (2010, Discussion section. para. 6), there may be a potential link between barriers in the setting and limited research use; however there is no direct evidence that a causal relationship exists. There have been no reported studies that investigate the relationship of perceived barriers or facilitators to research use measured using the DEBP questionnaire and actual research use.

2.5.6 Future Directions

One of the criticisms of previous work on identifying barriers to research use is its low impact. That is, the results have not been used to inform the development of strategies and interventions to promote research use (Kajermo et al., 2010). This study of factors influencing the implementation of EBP in Canadian audiology identified some strengths and gaps that could be addressed in future efforts to facilitate EBP in Canadian audiology.

1. The results of this study are quite positive; however, 18% to 36% of respondents indicated that they do not know how to find appropriate research reports, do not feel

confident in judging the quality of the reports, and find it difficult to understand the implications of research for practice. Therefore it is important that we continue our efforts to provide appropriate training opportunities for students and practicing audiologists to develop the appropriate skills for the development and implementation of evidence-based practice.

2. Future research should focus on investigating and identifying factors influencing busyness in the audiology practice context and research utilization (Thompson et al., 2008).
3. Some of the reported greatest facilitators to practice change appear to be related to valuing time to read and reflect on research during the work day, and reduction of the barriers to obtaining the literature (through access, funding and easily accessed research summaries). Future work should focus on examining strategies that might change organizational behaviour to facilitate access to evidence and time to read and plan for implementation in practice.
4. Finally, clinical audiologists work in various practice environments and are impacted by policy-level and provincial healthcare decisions. Future work should focus on obtaining a better understanding of how individual and contextual/environmental (institutional, cultural, physical, social) factors influence how knowledge is translated into clinical audiology practice (Metzler & Metz, 2010; Michie et al., 2005; Michie, van Stralen & West, 2011; Rycroft-Malone et al., 2004). This could develop contextually appropriate strategies for facilitating EBP across practice environments.

2.6 Conclusion

Results of this study indicated that Canadian audiologists generally rate themselves as competent in finding, evaluating and using research evidence to change practice. They use patient-acquired and experiential knowledge as primary sources in their practice; however they supplement this with research they learned about during training and continuing education opportunities. Canadian audiologists report the greatest barriers to changing practice on the basis of ‘best evidence’ are insufficient time at work to find research and/or organizational information and time at work to implement changes in

practice. They report that having open-access to journals, improved funding to attend continuing education opportunities and purchase appropriate equipment and time to read research, attend training sessions and implement research into practice would facilitate research utilization. Future work should focus on facilitating the continued development of appropriate evidence-based practice skills for Canadian audiologists, and improving our understanding of clinical audiology 'busyness' and other contextual factors that influence evidence-based practice in audiology in Canada.

2.7 References

American Academy of Audiology. *Core Values Statement*. Retrieved October 15, 2009 from http://www.audiology.org/about/information/Documents/CoreValuesModel.pdf

Aarons, G. A. (2006). Transformational and transactional leadership: Association with attitudes toward evidence-based practice. *Psychiatric Services, 57*, 1162-1169. doi:10.1176/appi.ps.57.8.1162

Bagatto, M. P., Scollie, S. D., Hyde, M. & Seewald, R. (2010). Protocol for the provision of amplification in the Ontario Infant hearing program. *International Journal of Audiology, 49*, S70-S79. doi: 10.3109/14992020903080751

Bentler, R., Eiten, L., Gabbard, S., Grimes, A., DeConde Johnson, C., Moodie, S., … Tharpe, A. M. (2004). Pediatric amplification guideline. *Audiology Today, 16*(2), 46-53. Retrived from http://www.audiology.org/resources/audiologytoday/

Bess, F. (2000). Early Amplification for Children: Implementing Change. In R. C. Seewald (Ed.), *A Sound Foundation Through Early Amplification: Proceedings of an International Conference* (pp. 247.251). Staffa, Switzerland: Phonak AG.

Bhattacharyya, O., Reeves, S., & Zwarenstein, M. (2009). What is implementation research? Rationale, concepts and practices. *Research on Social Work Practice, 19*(5), 491-502. doi: 10.1177/1049731509335528

Brown, T., Tseng, M. H., Casey, J., McDonald, R., & Lyons, C. (2011). Barriers to pediatric occupational therapists' research utilization in Australia, the United Kingdom, and Taiwan. *Journal of Occupational Therapy, Schools, & Early Intervention, 3*(4), 368-386. doi:10.1080/19411243.2010.541771

Carlson, C. L., & Plonczynski, D. J. (2008). Has the BARRIERS Scale changed nursing practice? An integrative review. *Journal of Advanced Nursing, 63*(4), 322-333. doi:10.1111/j.1365-2648.2008.04705.x

Claridge, J. A., & Fabian, T. C. (2005). History and development of evidence-based medicine. *World Journal of Surgery, 29*(5), 547-552. doi:10.1007/s00268-005-7910-1

College of Audiologists and Speech-Language Pathologists of Ontario. (2000). *Preferred practice guideline for the prescription of hearing aids to adults.* Toronto, ON: College of Audiologists and Speech-Language Pathologists of Ontario.

College of Audiologists and Speech-Language Pathologists of Ontario. (2002). *Preferred practice guideline for the prescription of hearing aids for children.* Toronto, ON: College of Audiologists and Speech-Language Pathologists of Ontario.

Cummings, G. G., Estabrooks, C. A., Midodzi, W. K., Wallin, L., & Hayduk, L. (2007). Influence of organizational characteristics and context on research utilization. *Nurse Researcher, 56*, S24-39. doi:10.1097/01.NNR.0000280629.63654.95

Curtin, M., & Jaramazovic, E. (2001). Occupational therapists' views and perceptions of evidence-based practice. *British Journal of Occupational Therapy, 64*(5), 214-222. Retrieved from http://www.ingentaconnect.com/content/cot/bjot

Damschroder, L., Aron, D., Keith, R., Kirsh, S., Alexander, J., & Lowery, J. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science, 4*(1):50. doi:10.1186/1748-5908-4-50

Davis, D. A., & Taylor-Vaisey, A. (1997). Translating guidelines into practice: A systematic review of theoretic concepts, practical experience and research evidence in the adoption of clinical practice guidelines. *Canadian Medical Association Journal, 157*(4), 408-416. Retrieved from http://www.cmaj.ca/content

Estabrooks, C. A., Floyd, J. A., Scott-Findlay, S., O'Leary, K. A., & Gushta, M. (2003). Individual determinants of research utilization: A systematic review. *Journal of Advanced Nursing, 43*(5), 506-520. doi: 10.1046/j.1365-2648.2003.02748.x

Estabrooks, C., Squires, J., Cummings, G., Birdsell, J., & Norton, P. (2009). Development and assessment of the Alberta Context Tool. *BMC Health Services Research, 9*:234. doi:10.1186/1472-6963-9-234

Funk, S. G., Champagne, M. T., Wiese, R. A., & Tornquist, E. M. (1991). BARRIERS: The barriers to research utilization scale. *Applied Nursing Research, 4*(1):39-45. doi:10.1016/S0897-1897(05)80052-7

Gerrish, K., Ashworth, P., Lacey, A., & Bailey, J. (2008). Developing evidence-based practice: experiences of senior and junior clinical nurses. *Journal of Advanced Nursing, 62*(1), 62-73. doi: 10.1111/j.1365-2648.2007.04579.x

Gerrish, K., Ashworth, P., Lacey, A., Bailey, J., Cooke, J., Kendall, S., …McNeilly, E. (2007). Factors influencing the development of evidence-based practice: a research tool. *Journal of Advanced Nursing, 57*(3), 328-338. doi:10.1111/j.1365-2648.2006.04112.x

Gerrish, K., & Clayton, J. (2004). Promoting evidence-based practice: an organisational approach. *Journal of Nursing Management, 12*(2), 114-123. doi:10.1111/j.1365-2834.2004.00454.x

Glasgow, R., & Emmons, K. (2007). How can we increase translation of research into practice? Types of evidence needed. *Annual Review of Public Health, 28*, 413-433. doi:10.1146/annurev.publhealth.28.021406.144145

Goodman, K. W. (2003). Foundations and history of evidence-based practice. In K. W. Goodman (Ed.), *Ethics and Evidence-Based Medicine: Fallibility and Responsibility in Clinical Science* (pp. 1-22). Cambridge, U.K.: University Press. Retrieved from: http://assets.cambridge.org/97805218/19336/excerpt/9780521819336_excerpt.pdf

Green, L. (2001). From research to "best practices" in other settings and populations. *American Journal of Health Behavior, 25*, 165-178. Retrieved from http://aahb.org/

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly, 82*(4), 581-629. Retrieved from http://www.milbank.org/

Grimshaw, J. M., Santesso, N., Cumpston, M., Mayhew, A., & McGowan, J. (2006). Knowledge for knowledge translation: The role of the Cochrane Collaboration. *The Journal of Continuing Education in the Health Professions, 26*(1), 55-62. doi:10.1002/chp.51

Grol, R. P. T. M., Bosch, M. C., Hulscher, M. E. J. L., Eccles, M., & Wensing, M. (2007). Planning and studying improvement in patient care: The use of theoretical perspectives. *Milbank Quarterly, 85*(1), 93-138. Retrieved from http://www.milbank.org/

Grol, R., & Grimshaw, J. (2003). From best evidence to best practice: effective implementation of change in patients' care. *Lancet, 362*, 1225-1230. doi:10.1016/S0140-6736(03)14546-1

Grol, R., & Wensing, M. (2004). What drives change? Barriers to and incentives for achieving evidence-based practice. *The Medical Journal of Australia, 180*, S57-S60. Retrieved from http://www.mja.com.au/

Grol, R., & Wensing, M. (2005). Characteristics of successful innovations. In R. Grol, M. Wensing, & M. Eccles, *Improving Patient Care: The Implementation of Change in Clinical Practice* (pp. 60-70). Oxford: Elsevier.

Heiwe, S., Kajermo, K. N., Tyni-Lenné, R., Guidetti, S., Samuelsson, M., Andersson, I.-L., …Wengström, Y. (2011). Evidence-based practice: attitudes, knowledge and behaviour among allied health care professionals. *International Journal for Quality in Health Care*. doi:10.1093/intqhc/mzq083

Henson, C., & Beck, D. L. (2008). Do real-ear measurements make a real difference to patient outcomes? Interview with Claire Henson, Leicester Royal Infirmary, England, *American Academy of Audiology*. Retrieved from http://www.audiology.org/news/interviews/Pages/20090119a.aspx.

Hutchinson, A. M., & Johnston, L. (2004). Bridging the divide: a survey of nurses' opinions regarding barriers to, and facilitators of, research utilization in the practice setting. *Journal of Clinical Nursing, 13*(3), 304-315. doi: 10.1046/j.1365-2702.2003.00865.x

Iles, R., & Davidson, M. (2006). Evidence based practice: A survey of physiotherapists' current practice. *Physiotherapy Research International, 11*(2), 93-103. doi:0.1002/pri.328

Ismail, A. I., & Bader, J. D. (2004). Evidence-based dentistry in clinical practice. *Journal of the American Dental Association, 135*(1), 78-83. Retrieved from http://jada.ada.org/

Kajermo, K. N., Boström, A. M., Thompson, D. S., Hutchinson, A. M., Estabrooks, C. A., & Wallin, L. (2010). The BARRIERS Scale - - the barriers to research utilization scale: A systematic review. *Implementation Science, 5*:32. doi:10.1186/1748-5908-5-32

King, A. (2010). The national protocol for paediatric amplification in Australia. *International Journal of Audiology, 49*, S64-S69. doi: 10.3109/14992020903329422

Kirkwood, D. H. (2010). Survey probes dispensers' views on key issues raised by Consumer Reports. *The Hearing Journal, 63*(5), 17-26. doi:10.1097/01.HJ.0000373446.75826.e1

Kochkin, S. (2011). MarkeTrak VIII: Reducing patient visits through verification & validation. *Hearing Review, 18*(6), 10-12. Retrieved from http://www.hearingreview.com/issues/

Kochkin, S., Beck, D. L., Christensen, L. A., Compton-Conley, C., Fligor, B. J., Kricos, P. B., … Turner, R. (2010). MarkeTrak VIII: The impact of the hearing healthcare professional on hearing aid user success. *Hearing Review, 17*(4):12-34. Retrieved from http://www.hearingreview.com/issues/

Kryworuchko, J., Stacey, D., Bai, N., & Graham, I. D. (2009). Twelve years of clinical practice guideline development, dissemination and evaluation in Canada (1994 to 2005). *Implementation Science, 4*:49. doi 10.1186/1748-5908-4-49

Légaré, F. (2009). Assessing barriers and facilitators to knowledge use. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 83-93). Hoboken: Blackwell Publishing Ltd.

Lemieux-Charles, L., & Barnsley, J. (2004). An Innovation Diffusion Perspective on Knowledge and Evidence in Health Care. In L. Lemieux-Charles & F. Champagne (Eds.), *Using Knowledge and Evidence in Health Care: Multidisciplinary Perspectives* (pp. 115-138). Toronto: University of Toronto Press.

Levin, A. (2001). Current clinical issues: The Cochrane Collaboration. *Annals of Internal Medicine, 135*(4), 309-312. Retrived from http://www.annals.org/content/

Lindley, G. (2006). Current hearing aid fitting protocols: Results from an on-line survey. *Audiology Today, 18*(3), 19-22. Retrived from http://www.audiology.org/resources/audiologytoday/

Masso, M., & McCarthy, G. (2009). Literature review to identify factors that support implementation of evidence-based practice in residential care. *International Journal of Evidence Based Healthcare, 7*(2), 145-156. doi:10.1111/j.1744-1609.2009.00132.x

McCluskley, A. (2003). Occupational therapists report a low level of knowledge, skill and involvement in evidence-based practice. *Australian Occupational Therapy Journal, 50*(1), 3-12. doi:10.1046/j.1440-1630.2003.00303.x

McCormack, B., Kitson, A., Harvey, G., Rycroft-Malone, J., Titchen, A., & Seers, K. (2002). Getting evidence into practice: The meaning of context. *Journal of Advanced Nursing, 2002*(38), 94-104. doi:10.1046/j.1365-2648.2002.02150.x

Metcalfe, C., Lewin, R., Wisher, S., Perry, S., Bannigan, K., & Klaber Moffett, J. (2001). Barriers to implementing the evidence base in four NHS therapies: Dietitians, occupational therapists, physiotherapists, speech and language therapists. *Physiotherapy, 87*(8), 433-441. doi:10.1016/S0031-9406(05)65462-4

Metzler, M. J., & Metz, G. A. (2010). Analyzing the barriers and supports of knowledge translation using the PEO model. *Canadian Journal of Occupational Therapy, 77*(3), 151-158. doi:10.2182/cjot.2010.77.3.4

Michael, B., & John, M. C. (2003). Bridging evidence-based practice and practice-based evidence: developing a rigorous and relevant knowledge for the psychological therapies. *Clinical Psychology and Psychotherapy, 10*(6), 319-327. doi:10.1002/cpp.379

Michie, S., Johnston, M., Abraham, C., Lawton, R., Parker, D., & Walker, A. (2005). Making psychological theory useful for implementing evidence based practice: A consensus approach. *Quality & Safety in Health Care,* 14, 26-33. doi: 10.1136/qshc.2004.011155

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterizing and designing behaviour change interventions. *Implementation Science, 6*:42. doi:10.1186/1748-5908-6-42

Modernising Children's Hearing Aid Services (2007). Guidance on the use of real ear measurement to verify the fitting of digital signal processing hearing aids. Retrieved from: http://www.thebsa.org.uk/docs/RecPro/REM.pdf.

Moodie, S. T., Kothari, A., Bagatto, M. P., Seewald, R. C., Miller, L., & Scollie, S. D. (2011). Knowledge translation in audiology: Promoting the clinical application of best evidence. *Trends in Amplification, 15*(1), 5-22. doi: 10.1177/1084713811420740

Mueller, H. G. (2003). In the words of Shakespeare: Fitting test protocols are "more honored in the breach than in the observance". *The Hearing Journal, 56*(10), 19-26. Retrieved from http://www.journals.lww.com/thehearingjournal/

Mueller, H. G., & Picou, E. M. (2010). Survey examines popularity of real-ear probe-microphone measures. *The Hearing Journal, 63*(5), 27-32. Retrieved from http://www.journals.lww.com/thehearingjournal/

Mullins, R. (2005). Survey tests members understanding of evidence-based practice. *ASHA Leader*, 4,11. Retrieved from http://www.asha.org/Publications/leader/2005/051108/051108c.htm

Pagoto, S. L., Spring, B., Coups, E. J., Mulvaney, S., Coutu, M.-F., & Ozakinci, G. (2007). Barriers and facilitators of evidence-based practice perceived by behavioral science health professionals. *Journal of Clinical Psychology, 63*(7), 695-705. doi:10.1002/jclp.2037

Portney, L. B., & Watkins, M. P. (2000). *Foundations of clinical research: Applications to practice* (2nd ed.). Upper Saddle River, NJ: Prentice Hall Health.

Rosenheck, R. (2001). Organizational process: A missing link between research and practice. *Psychiatric Services, 52*(12), 1607-1612. Retrieved from http://ps.psychiatryonline.org/

Rycroft-Malone, J., Harvey, G., Seers, K., Kitson, A., McCormack, B., & Titchen, A. (2004). An exploration of the factors that influence the implementation of evidence into practice. *Journal of Clinical Nursing, 19*, 913-924. doi:10.1111/j.1365-2702.2004.01007.x

Sackett, D. L., Rosenberg, W. M. C., Muir Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: what it is and what it isn't. *BMJ, 312*, 71-72. Retrieved from http://www.bmj.com/content/

Salls, J., Dolhi, C., Silverman, L., & Hansen, M. (2009). The use of evidence-based practice by occupational therapists. *Occupational Therapy in Health Care, 23*(2), 134-145. doi:10.1080/07380570902773305

Spring, B. (2007). Evidence-based practice in clinical psychology: What it is, why it matters, what you need to know. *Journal of Clinical Psychology, 63*(7), 611-631. doi:10.1002/jclp.20373

Strom, K. (2006). The Hearing Review 2006 Dispenser Survey, *The Hearing Review*. Retrieved from http://www.hearingreview.com/issues/

Strom, K. (2009). CR shows us a great opportunity, *The Hearing Review*. Retrieved from http://www.hearingreview.com/issues/

Thompson, D. S., O'Leary, K., Jensen, E., Scott-Findlay, S., O'Brien-Pallas, L., & Estabrooks, C. A. (2008). The relationship between busyness and research utilization: it is about time. *Journal of Clinical Nursing, 17*(4), 539-548. doi: 10.1111/j.1365-2702.2007.01981.x

Valente, M., Abrams, H., & Benson, D., Chisolm, T., Citron, D., Hampton, D., …Sweetow, R. (2006). Summary guidelines: Audiologic management adult hearing impairment. *Audiology Today, 18*(5), 32-36. Retrieved from http://www.audiology.org/resources/audiologytoday/

Veldhuizen, W., Ram, P., van der Weijden, T., Wassink, M. R., & van der Vleuten, C. P. M. (2007). Much variety and little evidence: A description of guidelines for doctor-patient communication. *Medical Education, 41*, 138-145. doi:10.1111/j.1365-2929.2006.02667.x

Yadav, B. L., & Fealy, G. M. Irish psychiatric nurses' self-reported sources of knowledge for practice. *Journal of Psychiatric and Mental Health Nursing.* Advance online version. doi:10.1111/j.1365-2850.2011.01763.x

Zipoli, R. P., Jr., & Kennedy, M. (2005). Evidence-based practice among speech-language pathologists: Attitudes, utilization, and barriers. *American Journal of Speech-Language Pathology, 14*(3), 208-220. doi:10.1044/1058-0360(2005/021)

Chapter 3

3 Knowledge translation in audiology: Promoting the clinical application of best evidence [1]

3.1 Evidence-based practice

The origins of evidence-based practice (EBP) come largely from clinical medicine. The EBP paradigm provides techniques and procedures to critically examine the abundance of scientific evidence in order to assist clinical decision making and improve the quality, effectiveness and efficiency of health services received by the public. The desired clinical outcome of EBP is an increase in the number of patients who get treatment of proven quality and effectiveness. The generally agreed-upon definition of EBP is that it is "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. Evidence-based practice integrates "individual clinical experience with the best available external clinical evidence from systematic research" (Sackett et al., 1996, p.71). Incorporating evidence into practice is regarded as a process that begins with a search for research literature about how best to solve specific clinical problems, and results in treatment decisions based on the best possible evidence (Stetler, 2001). As clinicians and their organizations learn more about EBP and the components of EBP, workshops, seminars, training kits, books and educational opportunities have been developed to assist clinicians in developing the necessary EBP skill set. These skills include the ability to: develop focused and appropriately structured clinical questions; search and locate high-quality evidence in the literature; evaluate the strength of the evidence; critically appraise the evidence; and implement evidence within the clinical context.

---

[1] A version of this chapter has been published. Moodie, S.T., Kothari, A., Bagatto, M.P., Seewald, R.C., Miller, L.T., and Scollie, S.D. (2011). Knowledge translation in audiology: Promoting the clinical application of best evidence. *Trends in Amplification*. *15*(1), 5-22. doi: 10.1177/1084713811420740

3.2 Evaluating the strength of the evidence: Hierarchy of evidence

In order to provide professionals with a method for ranking the quality of research, hierarchies of evidence were introduced in the early 1990s. According to Rolfe and Gardner (2006) this notion of a tree-like hierarchy was evident in the seminal 1992 paper on EBP published by the evidence-based medicine working group (EBMWG), and although it has been modified somewhat since that time, it still exists today (EBMWG, 1992). Table 3-1 shows an applied hierarchy of evidence used in the profession of audiology (adapted from Cox, 2005a). At the bottom of this hierarchy is expert opinion and case reports, which are often seen as unsystematic and subject to bias, thus making them the least 'trustworthy' sources of information to use when making treatment decisions. Randomized controlled trials (RCTs) are viewed as the 'gold standard' and are regarded as the most trustworthy sources of evidence because they are systematic and bias is greatly reduced; therefore they receive the highest ranking in the hierarchy.

Table 3-1: Level of evidence hierarchy for high-quality studies.

Level of Evidence	Type of study or other information
Highest Level	systematic reviews and meta-analyses of randomized controlled trials or other high-quality studies
	randomized controlled trials (rcts)
	nonrandomized intervention studies
	nonintervention studies: cohort studies, case-control studies, cross-sectional surveys
	case reports
Lowest Level	expert opinion

Adapted from "Evidence-based practice in provision of amplification" by R. M. Cox, 2005, *Journal of the American Academy of Audiology, 16*(7), p. 430. Copyright 2005 by American Academy of Audiology. Reprinted with permission.

It should be noted here that the requirement of randomized controlled trials (RCTs) as the highest-level of evidence in pediatric audiology presents considerable challenges. The incidence rate of permanent childhood hearing impairment of reportedly 1-3/1,000 births (Hyde, 2005a) can make obtaining sufficient sample sizes for RCTs in order to detect a clinically important effect difficult. It may also mean that pediatric audiology RCTs

would have to be multi-site in nature and this could become relatively expensive and time-intensive. There is certainly a lack of pediatric audiology research centers and researchers relative to adult audiology research centers. There are also unique ethical considerations when conducting research with very young children including concerns about consent by proxy and financial incentives to parents for enrolling their children in research studies (Cohen, Uleryk, Jasuja, & Parkin, 2007).

The historical purpose of EBP was to blend the clinical experiences of healthcare professionals; their skill and understanding of individual patient's needs; with their knowledge about the strengths, weaknesses, applicability of the evidence and the clinical significance of the treatment under consideration (Bess, 1995; Cox, 2005a; 2005b; Jerger, 2008; Palmer, 2007). The contemporary purpose of using an evidence-based approach to clinical practice is to close the gap between research and practice, reduce practice variation and to ultimately improve patient care based upon informed decision making. To start, locating and appraising the scientific literature can be a formidable task. Catherine Palmer and colleagues at the University of Pittsburgh have provided audiologists with a helpful article to assist with evaluation of the research literature in audiology (Palmer et al., 2008). However even with information to assist the process, most healthcare professionals may not have the time or the expertise to review the literature each time they have important clinical questions to be answered. Therefore, professionals and their organizations generally work together to provide scientific review of the relevant literature and produce succinct guidelines that clinicians can use as tools to inform evidence-based practice. These efforts are published as Clinical Practice Guidelines.

3.3 Clinical practice guidelines (CPGs)

In a 2007 article, George Weisz and colleagues describe the historical changes in health care that resulted in the development of CPGs (Weisz et al., 2007). These included: (a) the dissatisfaction with training and credentials in medicine and the wide variability of competence among practitioners; (b) the need for protocols and guidelines for complex therapeutic technologies and procedures (e.g., cancer treatment and in vitro fertilization);

and (c) the demand by the public for accountability, transparency and regulation. These factors have resulted in 'layer upon layer of guidelines' in health care (Weisz et al., 2007).

The most frequently used definition of CPGs is that they are "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (Field & Lohr, 1990, p.38). The systematic development of an evidence-based CPG begins with a well-formulated question about a specific clinical condition. It is also important at the beginning of the process to define the relevant populations and clinical settings, potential interventions and desired outcome measures. The next step is to conduct a comprehensive literature search and systematic review of the literature. Ideally, this work is conducted by a broad and representative sample of individuals from within the profession who have the skills required to independently and critically appraise the literature and apply the explicit grading criteria to document the findings and summarize the literature review (Dollaghan, 2007). When CPGs can be based on a large number of high-quality studies it reduces the need for recommendations based on expert opinion. In many of the health sciences professions, including audiology, much of the scientific research literature has significant limitations and/or lacks sufficient relevance, limiting its use as high-quality evidence (Hyde, 2005b). This leaves a CPG development group to decide whether they are willing to make recommendations based on less than adequate evidence. Often the end result is a frustrated committee who continue to try to write the guideline based on consensus and their expert opinions while trying to ensure that they do not introduce their own bias. The other result may be the production of a guideline with the neutral conclusion that there is insufficient evidence to make a recommendation (Hyde, 2005b; Kryworuchko, Stacey, Bai, & Graham, 2009; Weisz et al., 2007; Woolf, 2000). Knowing that the practice of guideline production is not perfect, a guideline committee works to draft a document that reflects the strength of the evidence and is offered as a means of improving patient care and outcomes while providing a strategy for more efficient use of resources (Graham, Beardall, Carter, Tetroe, & Davies, 2003).

3.4 Evidence-based practice and clinical practice guidelines in audiology

Audiology, like most of the health sciences professions, has been working on incorporating evidence-based practice principles into its mandate for professional practice since the mid-1990's (Bess, 1995; Wolf, 1999). A review of professional activity in speech-language pathology and audiology presented by Lass and Pannbacker (2008) show the commitment of The American Speech-Language-Hearing Association (ASHA) and The Canadian Association of Speech-Language Pathologists and Audiologists (CASLPA) in promoting the application of evidence-based principles in clinical practice, classrooms and research settings. Implementation of EBP is part of CASLPA's 2008 vision, mission and values statement and is included as a 'core value' by the American Academy of Audiology (AAA; AAA, n.d; CASLPA, n.d.). AAA defines EBP as "To practice according to best clinical practices for making decisions about the diagnosis, treatment, and management of persons with hearing and balance disorders, based on the integration of individual clinical expertise and best available research evidence." (AAA, n.d.). The publication of The Handbook for Evidence-Based Practice in Communication Disorders in 2007 provides professionals in the area of communication disorders with a resource which can be used to develop the skills to become critical consumers of research literature (Dollaghan, 2007).

In audiology, clinical uptake of evidence-based procedures can be relatively rapid. For example, when research indicated that the use of a higher probe-tone frequency (1000 Hz) provided a more valid indication of middle ear function for infants and young children (Keefe, Bulen, Arehart, & Burns, 1993), pediatric audiologists in clinical practice were relatively quick to implement this into their protocols, even though lower frequency probe-tone (220 to 226 Hz) measures were the standard for many years. On the other hand, there is still lack of adherence to best practice recommendations for the use of other important clinical measures. For example, real-ear probe-microphone measures for the fitting and verification of hearing aids have been an important component of best practice guidelines for adults and children for many years (AAA, 2003; Bagatto, Scollie,

Hyde, & Seewald, 2010; College of Audiologists and Speech-Language Pathologists of Ontario [CASLPO], 2000; 2002; Joint Committee on Infant Hearing [JCIH], 2000; JCIH, 2007; King, 2010; Modernizing Children's Hearing Aid Services [MCHAS], 2007; Valente et al., 2006). In clinical practice however, studies have shown that 59% to 75% of adult hearing aid fittings are *not* verified with real-ear measures of hearing aid performance (Lindley, 2006; Mueller & Picou, 2010; Strom, 2006; 2009), despite the fact that these measures are related to customer satisfaction (Kochkin et al., 2010). Recent research indicates that individuals who had purchased hearing aids that were *not* verified with real-ear probe-microphone measures at the time of fitting were significantly less (by 18%) satisfied with their hearing aids after one year than individuals who had real-ear probe-microphone measures performed at the time of fitting (Henson & Beck, 2008). It is often suggested that lack of uptake is associated with lack of understanding about real-world practice by those extolling the virtues of EBP. The current challenge facing the practice of audiology is how do we address the knowledge-to-action (KTA) gaps? In recent years, the profession of audiology in North America has worked diligently to produce high-quality CPGs, make them available to audiologists and to work with professionals and students to ensure that they have the skills to evaluate the guideline and implement it for use with their individual patients (Kent, 2006; Orange, 2004). But it does not appear that the multiple practice organizations are working together to coordinate guideline development, training, or uptake. There is a lack of knowledge in audiology about the possibility of using national and/or international repositories so that a CPG produced by an organization in a specific content area might serve as a template or starting point for another organization working on the same CPG topic. Instead, each organization is producing its own practice guidelines leading to a multitude of CPGs on the same topic.

3.5 Criticisms and challenges of evidence-based practice

Most professionals support the fundamental reasoning behind EBP. However, since the early 2000s, scholars have started to voice criticism over EBP. In a recent article several authors lament that EBP reduces health care to a "routinised, quantifiable practice driven

by utility, best practices and reductive performance indicators" (Murray, Holmes, & Rail, 2008, p.276).

Some of the most common criticisms of evidence-based practice include: (a) the current definitions of 'gold standard' research are restrictive; (b) the use of expert opinion is undervalued; (c) the shortage of coherent, consistent scientific evidence limits the ability to conduct EBP reviews; (d) there are difficulties in applying evidence in the care of individual patients; (e) it denigrates the value of clinician and patient experience; and (f) time constraints, skill development, and resource limitations restrict its application (Cohen, Stavri, & Hersh, 2004; Mullen & Steiner, 2004; Murray et al., 2008; Rolfe & Gardner, 2006; Straus & McAlister, 2000).

3.5.1 Alterations in the view of what constitutes 'gold standard' status in evidence hierarchies

A primary trait of the EBP hierarchy of evidence is the ranking of randomized controlled trials (RCTs) as the 'gold standard'. Despite initial widespread promotion of this grading system, recent publications have suggested alternative methods (see Rolfe & Gardner, 2006 for more detail). Some members of teams who promoted a hierarchy of evidence with systematic reviews of RCTs as the gold standard have recently rescinded their belief that this is appropriate (Thompson, 2002). Some experts have moderated their views by advocating different gold standards or different hierarchies for different questions (DiCenso, Cullum, & Ciliska, 1998; Evans, 2003; Logan, Hickman, Harris, & Heriza, 2008). The Joanna Briggs Institute, an international not-for-profit research and development organization specializing in evidence-based resources for healthcare professionals, has twice modified its Level IV evidence criteria; once in 1999 and again in 2004 (Rolfe & Gardner, 2006). The changes had to do with accepting and/or denying clinical experience and expertise as forms of evidence. An important point in this discussion is that any changes in hierarchy criteria may impact the ongoing validity of previously developed evidence reviews and resulting CPGs (Rolfe & Gardner, 2006).

3.5.2 Expert opinion versus evidence

There continues to be ongoing debate on the use of scientific knowledge versus clinical expertise in EBP across health sciences professions (Fago, 2009; Wolf, 2009; Zeldow, 2009). The proponents of EBP would argue that the current definition of EBP includes clinical expertise and patient values. They would also argue that clinicians can, at times, choose to override the scientific evidence and still be engaged in EBP. However, it is important to note that relying solely on clinical judgment and expertise has known problems. Opinion can be affected by such factors as past and/or personal experience, belief in and expectation for success, selective use of evidence, predetermined bias, motivation, distortion of memory, persistence in belief that there is only one best way to do something, professional norms, business pressures, and other factors (Ismail & Bader, 2004; Kane, 1995; Rinchuse, Sweitzer, Rinchuse, & Rinchuse, 2004; Woolf, 2000). For these reasons, an approach to integrating and balancing information from research, from clinical experience, and from individual patient needs, remains an important goal. The following section will discuss the specific difficulties encountered when trying to integrate these three sources of information.

3.5.3 Difficulties in applying evidence in the care of individual patients

A major criticism of EBP is based on providing clinicians with study results that are established from trends from group data based on average behaviors of ‘acceptably similar’ groups of subjects (Cohen et al., 2004; Mullen & Steiner, 2004; Murray et al., 2008). This ignores the fact that there is always group and individual variability. If a clinician blindly applies a ‘proven’ procedure assuming the individual will benefit there could be a significant practice error. For example, infants are not average adults. Until the 1990s, the predicted real-ear sound pressure levels delivered by hearing aids were largely based on measurements of the acoustic characteristics of average adult ears. We know that an infant’s ear is much smaller than an adult’s ear. The output of a hearing aid fitted to an infant’s ear using these ‘average’ adult transformation values could be 30 decibels greater at some frequencies than the same hearing aid on an adult’s ear (Seewald,

Moodie, Scollie, & Bagatto, 2005; Seewald & Scollie, 1999). Speech sounds and loud environmental sounds could be over-amplified, potentially causing discomfort and increased risk of additional hearing loss. Unfortunately, the infant cannot tell anyone the hearing aid is too loud because of their lack of communication skills. Treating individuals like 'the masses' is a valid criticism and it can be addressed in numerous ways.

3.5.4 Denigrates the value of clinician and patient experience

Evidence-based practice can be seen as both "self-serving and dangerously exclusionary in its epistemological methodologies" (Murray et al., 2008, p.275). By relying primarily on the 'methodological fundamentalism' associated with RCTs and quantitative evidence, other forms of knowledge including clinician and patient experiences are denigrated (House, 2003; Murray et al., 2008). Critics of the current state of EBP emphasize that there are other sources and types of clinically relevant and important evidence and additional ways to categorize quality (Cohen et al., 2004; Upshur, VanDenKerkhof, & Goel, 2001). They also caution that by depreciating the value of clinician and patient experience we are not fully 'treating' our patients with the *best* evidence (Charlton & Miles, 1998).

3.5.5 Time constraints, skill development, and resource limitations

If professionals are going to implement EBP procedures into their work life, they must develop the necessary skills to find and critically appraise the evidence. This takes time and resource allocation from not only a personal level, but from an organization level as well. Even if the evidence is gathered and organized for clinicians (as it often is in CPGs), the implementation of evidence into practice often takes redefining or learning a new skill set. This also takes time because it is easier to habitually continue to do what you know how to do than it is to implement something new into your repertoire (Rochette, Korner-Bitensky, & Thomas, 2009).

An examination of health sciences research literature on barriers to implementing evidence into clinical practice reveals that 'lack of time' is a major limitation cited by most clinicians across professions (Iles & Davidson, 2006; Maher, Sherrington, Elkins,

Herbert, & Moseley, 2004; McCleary & Brown, 2003; McCluskley, 2003; Mullins, 2005; Zipoli & Kennedy, 2005). The same authors note 'lack of skill or knowledge' about implementing EBP or reviewing research literature as another limitation across the health science professions. The virtual explosion of articles and books written about EBP and EBP procedures for specific professions also can make it overwhelming for the clinician who is interested in studying the topic (Rochette et al., 2009).

3.6 Limitations of CPGs

Given shortcomings in EBP, it is not surprising that there are limitations associated with the development and use of CPGs. The most fundamental limitation of CPGs is that they often do not change practice behavior. Analyses of the barriers to practice change indicate that obstacles to change arise at many different levels including: (a) at the level of the guideline; (b), the individual practitioner; (c), the organization; (d), the wider practice environment; and (e) at the level of the patient (Francke, Smit, de Veer, & Mistiaen, 2008; Greenhalgh, Robert, Macfarlane, Bate & Kyriakidou, 2004; Grol & Grimshaw, 2003; Grol, Bosch, Hulsher, Eccles, & Wensing, 2007; Légaré, 2009; Rycroft-Malone, 2004). A discussion of the first four limitations listed above is provided in the following sections and a summary is provided in Appendix A. A discussion of patient related behavior that affects the use of evidence in practice will not be provided in this manuscript as it is not the focus of this current work.

While the following section discusses the characteristics of guidelines, practitioners, organization and practice environments as obstacles to implementation of evidence, it should be noted that many of these same characteristics could be facilitators to implementation of evidence in practice. Facilitators are factors that promote or assist implementation of evidence-based practice (Légaré, 2009). For example, lack of time could be a considerable barrier, but having enough time would facilitate the transfer of evidence into practice. Similarly, clinician attitude to implementation of guidelines into clinical practice could be a barrier or facilitator depending on if the attitude was conducive to change or not.

3.6.1 Characteristics of *guidelines* that affect implementation in clinical practice

The Appraisal of Guidelines Research and Evaluation (AGREE) Instrument has outlined the criteria that CPGs should meet in order to provide practitioners with comprehensive and valid practice recommendations (www.agreetrust.org; AGREE Collaboration, 2001; The AGREE Collaboration Writing Group et al., 2003). AGREE recommendations suggest that explicit information related to the following domains should be clearly presented as part of guidelines: scope and purpose; stakeholder involvement; and rigour of development (including quality of evidence informing recommendations; clarity and presentation; applicability; and editorial independence) (AGREE Collaboration, 2001; The AGREE Collaboration Writing Group et al., 2003). Research that appraises guidelines in the health sciences professions has shown that many guidelines do not meet the AGREE criteria for high quality and this may have an impact on their use (Bhattacharyya, Reeves, & Zwarenstein, 2009; Veldhuizen, Ram, van der Weijden, Wassink, & van der Vleuten, 2007). In a recent review of guideline development, dissemination and evaluation in Canada it was reported that most guidelines were English only publications. In addition, 6% of the written guidelines submitted to the Canadian Medical Association Infobase did not indicate a review of the scientific literature and less than half of the guidelines graded the quality of the evidence (Kryworuchko, Stacey, Bai, & Graham, 2009).

Table 3-2 provides an overview of guideline characteristics that might influence their adoption in clinical practice (Grol et al., 2007; Grol & Wensing, 2005).

Table 3-2: Characteristics of guidelines/innovations that might hinder or promote their implementation.

Characteristic	Description
relative advantage or utility	better than existing or alternative working methods
compatibility	consistent with existing norms and values
complexity	easy to explain, understand and use
costs	balance between cost and benefits, necessary level of investment
risks	degree of uncertainty about result or consequences
flexibility, adaptability	degree to which innovation can be adapted to needs/situation of target group
involvement	degree to which target group is involved in development and the potential that their input has modified or resulted in adaptation(s)
divisibility	degree to which parts can be tried out separately and implemented separately
visibility, observability	degree to which other people can see and observe the results
trialability, reversibility	degree to which an innovation can without risk be tried out, stopped, or reversed if it does not work
centrality	degree to which the innovation affects central or peripheral activities in the daily working routine
pervasiveness, scope, impact	how much of the total work is influenced by the innovation, how many persons are influenced, how much time it takes, and what the influence on social relationships is
magnitude, disruptiveness, radicalness	how many organizational, structural, financial and personal measures the innovation requires
duration	the time period within which the change must take place
form, physical properties	what sort of innovation or change it is (material or social, technical or administrative, etc)
collective action	degree to which decisions about the innovation must be made by individuals, groups or a whole institution
presentation	nature of presentation, length, clarity, attractiveness

Note. Reprinted from "Characteristics of successful innovations, " by R. Grol and M. Wensing. In R. Grol, M. Wensing, & M. Eccles, *Improving Patient Care: The Implementation of Change in Clinical Practice* (pp.65). Copyright 2005 by Elsevier. Reprinted with permission.

3.6.2 Characteristics of the *practitioner* that affect implementation of guidelines in clinical practice

There have been numerous studies examining the obstacles to EBP by individual practitioners in health care (Bhattacharyya et al., 2009; Carlson & Plonczynski, 2008; Damschroder et al., 2009; Davis & Taylor-Vaisey, 1997; Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003; Green, 2001; Iles & Davidson, 2006; Ismail & Bader, 2004; Kryworuchko et al., 2009; Légaré, 2009; Michael & John, 2003; Mullins, 2005; Pagoto et al., 2007; Veldhuizen et al., 2007; Zipoli & Kennedy, 2005). Lack of time is ranked as the greatest obstacle to implementing evidence and/or CPGs into clinical practice. Table 3-3 provides a list of other factors cited in the literature that hinder practitioner-level implementation of evidence and/or guidelines in clinical practice.

Table 3-3: Characteristics of the practitioner that influence guideline adoption and implementation.

Characteristic
• perception or reality that it will take too much clinical time to implement
• lack of authority to change practice
• lack of support from organization for practice change
• perception of legitimacy of the source of the guideline
• perception of quality/validity of guideline
• habits/customs of clinicians or organization
• beliefs of clinician – peers/colleagues
• social norms/practice norms
• clinician attitude with respect to the use of guidelines in practice
• lack of outcome expectancy
• lack of self-efficacy
• lack of motivation
• lack of awareness of existence of guideline
• chosen non-compliance
• age of clinician

3.6.3 Characteristics of the *context* in which the practitioner works that affects implementation of guidelines in clinical practice

Context can be defined as the environment or setting in which people receive services, or, the clinical setting in which proposed evidence-based uptake is to take place (Rycroft-Malone, 2004). The context is dynamic and interacts with the individuals and the systems in which they work (Estabrooks, Squires, Cummings, Birdsell, & Norton, 2009; Masso & McCarthy, 2009; McCormack et al., 2002; Rycroft-Malone, 2004). The contexts in which practitioners work can have a significant impact on their ability to change practice behaviour primarily because of the focus on standard operating procedures and behavioural norms (Rosenheck, 2001). The importance of leadership within the practice context is imperative for change to take place (Aarons, 2006; Cummings, Estabrooks, Midodzi, Wallin, & Hayduk, 2007; Estabrooks et al., 2009; Masso & McCarthy, 2009). Table 3-4 provides a list of characteristics of the context that influence guideline adoption and implementation (Aarons, 2006; Cummings et al., 2007; Damschroder et al., 2009; Davis & Taylor-Vaisey, 1997; Estabrooks et al., 2009; Glasgow & Emmons, 2007; Greenhalgh et al., 2004; Masso & McCarthy, 2009; McCormack et al., 2002; Rosenheck, 2001; Rycroft-Malone, 2004).

Table 3-4: Characteristics of the context in which practitioners' work that influence guideline adoption and implementation.

Characteristic
• structure of the workplace/institution • organizational agenda • support for change/conduciveness to change • available resources • staff capacity / staff 'turn-over' • organization of care processes • efficiency of the system • degree to which the organization is networked both within the organization and with other external organizations (social capital of practitioners and organization) • level of inservice education; continuing education opportunities • policy and procedure documentation • leadership with good communication • relationships between practitioners and between practitioners and manager(s)

3.6.4 Characteristics of the *broader healthcare system* that affects implementation of guidelines in clinical practice

As shown in Table 3-5, the broader healthcare system is also a factor in guideline adoption and implementation (Bhattacharyya et al., 2009; Davis & Taylor-Vaisey,1997; Grol & Wensing, 2004; Grol et al., 2007).

Table 3-5: Characteristics of the broader healthcare system that influence guideline adoption and implementation.

Characteristic
• nature of financial arrangements/reimbursement to health professionals and to their organizations • support for change • regulation of health professions • financial stability • pressure from other health professions or the public

3.7 Putting evidence in its place: Evidence-based practice and knowledge translation (KT)

Tables 3-2 through 3-5 make it clear that implementation or uptake of new knowledge into changes in clinical practice is not generally achieved simply by creating the knowledge, distilling it into useable CPG formats and disseminating it to clinicians, administrators and/or policy-makers. In an effort to close the knowledge-to-clinical action gap, many of the health sciences professions are taking a knowledge translation (KT) approach to the development and dissemination of evidence for clinical practice.

The Canadian Institutes of Health Research (CIHR) defines KT as a "dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system." The definition is combined with a description of the KT process. "KT takes place within a complex system of interactions between researchers and knowledge users which may vary in intensity, complexity and level of engagement depending on the nature of the research and the findings as well as the needs of the particular knowledge user." (CIHR, n.d.). This definition has been adopted by the United States National Center for Dissemination of Disability Research and the World Health Organization (WHO) (Straus, 2009).

3.8 The Knowledge-to-Action (KTA) framework: A model for knowledge translation (KT) in audiology

After reviewing 31 different conceptual knowledge translation (KT) frameworks, Graham and colleagues (2006) developed a two-category KT framework that has been widely adopted by researchers and may be useful for consideration by the profession of audiology. They divide KT into two categories: 1) end-of-grant KT; and 2) integrated KT (Graham et al., 2006; Graham & Tetroe, 2007). *End-of-grant KT* includes research dissemination, communication, summary briefings to stakeholders, educational sessions

with practitioners and publications in peer-reviewed journals. Moving a KT product from the research laboratory into industry is also considered a form of end-of-grant KT. *Integrated KT* represents a more modern way of conducting research studies and involves active collaboration between researchers and research users in all parts of the research process, including designing the research questions, shared decision-making regarding methodology, data collection and tools development involvement, interpretation of the findings and dissemination and implementation of the research results. One significant advantage to an integrated KT approach to research is that it should enhance the development of best evidence, because the collaborative approach takes into consideration values, preferences and determinants to implementing change in clinical practice. (Graham et al., 2006; Graham & Tetroe, 2007; Harrison, Légaré, Graham, & Fervers, 2010; Straus, Tetroe, & Graham, 2009). The end result should be a reduction of the barriers to implementation of evidence summarized in Appendix A, and more high quality, effective and efficient health care services delivered to the public.

An integrated KT method that may be applied to evidence-based audiology research is the Knowledge-to-Action (KTA) Process (Graham et al., 2006; Harrison et al., 2010; Straus, Tetroe, & Graham, 2009). The KTA process is illustrated in Figure 3-1. There are **two cycles** occurring in the KTA method: 1) **a knowledge creation funnel;** and 2) an **application of knowledge cycle**. The boundaries between the two cycles can be 'permeable and fluid' if desired, or one cycle could be independent from the other (Graham et al., 2006; Graham & Tetroe, 2007; Straus, Tetroe, & Graham, 2009).

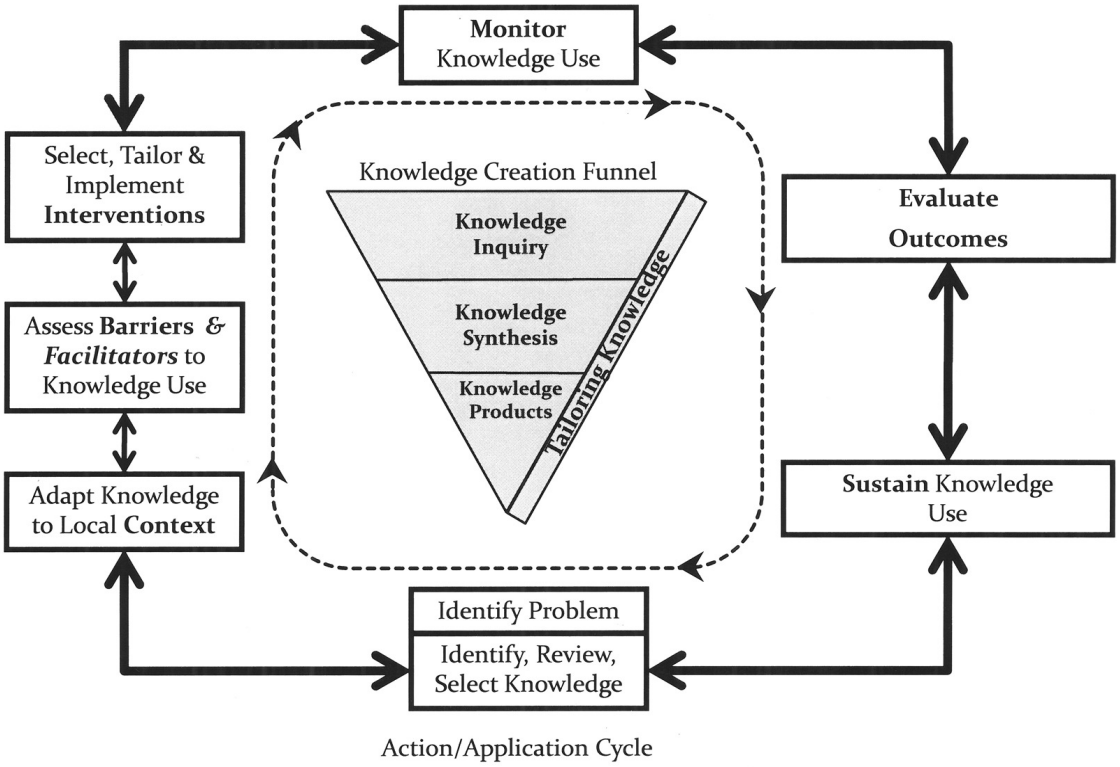


Figure 3-1: The knowledge-to-action process (Graham et al., 2006).

Adapted from "Lost in knowledge translation: Time for a map?" by I. Graham, J. Logan, M. B. Harrison, S. Straus, J. Tetroe, W. Caswell, & N. Robinson, 2006, *The Journal of Continuing Education in the Health Professions, 26,* p. 19. Copyright 2006 by John Wiley and Sons. Reprinted with permission.

The knowledge creation funnel takes the multitude of available evidence, or works with end-users of research to create the evidence (at the knowledge inquiry stage) and synthesizes it (synthesis stage), ultimately filtering it until the best evidence is compiled (see Figure 3-1). At the final stage, knowledge, in the form of knowledge tools or products, is presented in clear, concise and appropriate formats to influence clinical practice, stakeholders, and end-users in such a way to promote uptake of the knowledge. An important component to the knowledge creation cycle is that at each stage the knowledge should be tailored and/or customized, ideally with input from the end users, to facilitate implementation.

The **action (application) cycle** of the process facilitates the science of implementation (see Figure 3-1). It represents the various activities that may be needed for the application of the knowledge in clinical practice.

The action cycle includes:

- identification of a problem that needs addressing/ identification, review and selection of knowledge/research relevant to addressing the problem;
- adaptation of the evidence / knowledge / research to the local context;
- assessment of the barriers (and facilitators) to using the knowledge;
- selecting, tailoring and implementing interventions to promote the use of the knowledge within clinical practice settings;
- monitoring of knowledge use;
- evaluation of clinical uptake outcomes of using the knowledge;
- methods to sustain ongoing knowledge use.

The development of the application of knowledge cycle in this model has taken into consideration many of the criticisms related to EBP reported in the literature. (Cohen et al., 2004; Graham et al., 2006; Mullen & Steiner, 2004; Murray et al., 2008; Upshur et al., 2001). By actively collaborating with the end-users of the knowledge it places value on their experience and opinion and considers important factors related to time, skills, attitude, resources and organizational practice that impact the use of knowledge in clinical practice. The importance of considering application of knowledge in audiology-based knowledge translation activities is discussed below.

3.8.1 Identification of a problem/identification, review and selection of knowledge or research relevant to the problem

One of the first steps in knowledge creation or implementation in any of the health care professions, including audiology, is the identification of a problem or clinical knowledge-practice gap that deserves attention. A search for relevant knowledge or research that addresses the problem is undertaken, followed by a critical appraisal to determine the validity/usefulness of the knowledge to address the problem (Graham et al., 2006). Alternatively, useful/valid knowledge, such as a clinical practice guideline, can be made available and an individual or group may then determine if a clinical-practice gap exists that can be reduced or eliminated with the application of the knowledge.

3.8.2 Adaptation of the evidence / knowledge / research to the local context

Once valid and useful knowledge/research and/or evidence becomes available, it is important to look at the contexts in which the knowledge will be used to determine if adaptations are necessary to ensure uptake in practice occurs. Audiologists work in a variety of practice contexts. Many audiologists work in private practice; others work in hospital or rehabilitation settings; while others work in public health, industry, universities, schools, and other health-care settings. These practice contexts may differ in their workplace structure, organizational agenda and/or leadership. Similar to other knowledge translation frameworks such as the The Promoting Action on Research Implementation in Health Services (PARiHS) framework (Rycroft-Malone et al., 2002); the KTA framework postulates that the implementation of evidence will be most successful when necessary adaptations appropriate for the clinical context have been considered (Graham et al., 2006; Graham & Tetroe, 2007; Rycroft-Malone et al., 2002; Straus, Tetroe, & Graham, 2009).

3.8.3 Assessment of the barriers to using the knowledge

According to much of the recently published implementation research, implementation interventions are likely to be more effective if they target causal determinants of behavior (Michie, Johnson, Francis, Hardeman, & Eccles, 2008; Michie, van Stralen, & West, 2011). An audiologist may not implement or adhere to a CPG for fitting hearing aids to adults for example if she/he perceives there is a lack of beneficial outcome in doing so. If an audiologist lacks confidence in performing a real-ear probe-microphone measurement it will likely reduce their desire to implement the measurement into practice. An assessment to barriers to using the evidence in clinical practice provides an opportunity to determine how to overcome the barriers to facilitate behavior change.

3.8.4 Selecting, tailoring and implementing interventions to promote the use of the knowledge within clinical practice settings

If one considers the context in which the audiologist works and the barriers to practice change, then implementation interventions could be developed to promote the use of the knowledge in the practice setting. For example, if it has been identified that audiologists lack confidence in accurately performing real-ear probe-microphone measurements of hearing aid performance then tailored, hands-on, educational opportunities might be considered to reduce this confidence barrier.

3.8.5 Monitoring of knowledge use

After an implementation intervention has occurred, it is important to determine how and to what extent the knowledge has been translated into clinical use (Straus, Tetroe, Graham, Zwarenstein, & Bhattacharyya, 2009). In audiology, for example, monitoring the use of knowledge could entail measuring a change in knowledge, understanding, or attitude toward the performance of real-ear probe-microphone measurements. We could also perform measurements of the frequency at which real-ear probe-microphone measurements were made after our targeted hands-on intervention. Monitoring of knowledge use could also alter barriers at administration levels. For example, if evidence-based research shows that the performance of real-ear probe-microphone measurements provides patient benefit, reduces hearing aid returns, and the time it takes to achieve a satisfactory fitting over not performing the measurement, then we could use this information to persuade a hospital administrator to provide appropriate appointment time for an audiologist to conduct the measurements.

3.8.6 Evaluation of clinical uptake outcomes of using the knowledge

An important phase of the KTA framework is not only evaluating whether the application of knowledge has made a difference in terms of achieving good health and satisfaction outcomes for the individuals in our care; but on assessing whether application of the knowledge has had an impact on practitioner and system-level outcomes. It is important to evaluate the process level impact on the professionals using the knowledge in clinical

practice. It is also important to evaluate the impact, including the cost, associated with applying the knowledge at the level of the health-care system (Straus et al., 2009).

3.8.7 Methods to sustain ongoing knowledge use

Sustainability can be defined as "the degree to which an innovation continues to be used after initial efforts to secure adoption is completed" (Rogers, 2005, p. 429). One challenge to sustainability of knowledge use in audiology is within the organizational structure. If organizational structures do not intrinsically change to support the new evidence being put into practice, then audiologists will have a tendency to revert back to their former ways of doing things. Flexible knowledge sustainability strategies need to be considered during the development stages of CPGs (Davies & Edwards, 2009).

3.9 Why is knowledge translation (KT) important to audiology?

Despite the fact that the profession of audiology works to develop best practice guidelines and protocols based on the best available evidence, there is often an apparent failure to use this research evidence in clinical practice and/or to use it to inform decisions made by managers and/or policy-makers (Kirkwood, 2010; Lindley, 2006; Mueller, 2003; Strom, 2006; 2009). The determinants to the use or non-use of knowledge in clinical practice were tabulated in Tables 3-2 through 3-5. End-of-grant and integrated KT approaches (the KTA framework) could be used in audiology to ensure that factors influencing uptake of evidence in clinical practice including characteristics of the guidelines, the individual practitioner and the contexts/settings in which the knowledge is used are better understood and addressed. There are some potential limitations in using an integrated knowledge translation approach to knowledge development. These include the potential for increased cost and time for guideline development using this iterative approach; and difficulty obtaining release-from-practice time for audiologists to participate in the guideline development process without financial reimbursement to the employer (Friberger & Falkman, 2011). It may be difficult to reach consensus between clinicians and researchers on what constitutes an acceptable modification to a guideline.

More research on these aspects of active collaboration between researchers and end-users is needed to address these important issues. One positive aspect of research work to date is that government-level funding agencies such as the Canadian Institutes of Health Research (CIHR) and the National Institutes of Health (NIH) are providing funding for knowledge translation projects that actively engage end-users of research (patients, clinicians and/or policy-makers).

3.10 Communities of practice in audiology: Facilitators of knowledge into action

An examination of the factors influencing evidence uptake that appear in Tables 3-2 through 3-5 (summarized in Appendix A), provides us with a better understanding of why there is a knowledge-to-action (KTA) gap. The factors also reveal the complex processes involved in diffusion of knowledge and behavior change. The complexity may be reduced with early and ongoing involvement of researchers, practitioners, policy-makers and patients (Innvaer, Vist, Trommald, & Oxman, 2002; Landry, Amara, & Lamari, 2001; Lomas, 2000; McWilliam et al., 2009; Roux, Rogers, Biggs, Ashton, & Sergeant, 2006; Straus, 2009). The translation of knowledge or evidence into clinical practice is an active process. In the KTA model the process is "iterative, dynamic, complex, concerning both knowledge creation and application (action cycle) with fluid boundaries between creation and action components" (Graham et al., 2006; Straus, 2009, p. 6).

Both the creation of knowledge and application of knowledge in practice are social processes and as such communities of practice have the potential to reduce the KTA gap, assist with knowledge diffusion and be facilitators of practice change. One of the primary advantages in terms of diffusion of knowledge and clinical practice behavior change is that by collaborating with practitioners we have individuals who will know how to "grease the implementation wheels and provide a road map to the potential mine fields inherent in attempting to introduce change in any organization" (Graham & Tetroe, 2009, para. 11).

Communities of practice (CoPs) are comprised of individuals who share common concern or enthusiasm about a topic or problem, and who deepen their knowledge and expertise about the area by frequently interacting with one another (Barwick et al., 2005; Li et al., 2009; Wenger, McDermott, & Snyder, 2002). Initially described in 1991, the term CoP has evolved to be defined as a group of people with a unique combination of three structural concepts: the *domain of knowledge*, a *community of people*, and *shared practice* (Barwick, 2008; Barwick et al., 2005; Li et al., 2009; Wenger et al., 2002). The *domain* creates mutuality and a common focus regarding the key issues among members and inspires them to contribute their knowledge and ideas. The *community* creates the social structure that is imperative for knowledge creation, collective learning, inquiry, relationships and trust. The *shared practice* are resources created, used and shared by the group that include documents, ideas, information, ways of knowing, and experiences (Barwick, 2008; Roux et al., 2006; Wenger, 2005). When the three structural concepts of CoPs work together they can optimize the creation and dissemination of knowledge thereby facilitating the KTA process (McWilliam et al., 2009).

3.10.1 Value of a community of practice for pediatric audiology

Approximately 30% of children in North America who are fitted with hearing aids are receiving care that is inconsistent with evidence-based CPGs (Bess, 2000; Lindley, 2006). In a 2003 paper, it was noted that, “There is a current trend to develop test protocols that are “evidence based.” . . . But, before we develop any new fitting guidelines, maybe we should first try to understand why there is so little adherence to the ones we already have” (Mueller, 2003, p.26). In the area of pediatric audiology every effort is made to ensure that CPGs are developed using systematic reviews and the best available evidence. A review of the literature indicates that to date no systematic appraisal of pediatric amplification CPGs or their implementation has been conducted. Therefore, it is difficult to say whether it is the guideline or implementation factors that account for the fact that these children are not receiving care based on current CPGs. Appendix A provides us with information on why we may have adherence issues. Utilizing a collaborative and integrated KT approach to the development and subsequent

implementation of knowledge into clinical practice may provide insight into how to reduce the barriers and facilitate the movement of evidence into practice.

Brown and Duguid (2001) state that "knowledge runs on rails led by practice" (p.204). Developing a CoP in pediatric audiology could facilitate the knowledge creation cycle in an integrated KT approach by utilizing an engaged community with a shared understanding of the knowledge needed and who would have the ability to assist in tailoring or customizing the knowledge for better use among intended users (Fung-Kee-Fung et al., 2009; Gajda & Koliba, 2007; 2008; Koliba & Gajda, 2009; Salisbury, 2008a; 2008b; Stahl, 2000). CoPs provide an opportunity for the creation of knowledge and knowledge products to include the tacit knowledge that experienced practitioners have accumulated through years of practice (Allee, 2000; Brown & Duguid, 2001; McWilliam et al., 2009; Serrat, 2008). This tacit knowledge makes it possible for them to be advocates and facilitators in the development of resources that reflect accumulated ways of knowing, and experiences which will meet the cognitive needs of novice practitioners and the experiential needs of expert practitioners (Salisbury, 2008a; 2008b; Stahl, 2000).

3.10.2 Examples of communities of practice in health care

The next section of this paper will provide a description of two successful Canadian-based CoP programs in healthcare. The first, Cancer Care Ontario/Program in Evidence-Based Care (Browman et al., 1995; Browman, Makarski, Robinson, & Brouwers, 2005; Evans, Graham, Cameron, Mackay, & Brouwers, 2006; Fung-Kee-Fung et al., 2009; Stern et al., 2007) is of interest because it focuses on the use of practitioners during the guideline development process. The second, Ontario Children's Mental Health Child and Adolescent Functional Assessment Scale, (CAFAS) Initiative (Barwick, Boydell, & Ormin, 2002; Barwick, Peters, & Boydell, 2009; Barwick et al., 2005) is of interest because it relates to work in the pediatric population.

3.10.3 CPG Development: Guiding practice of cancer care in Ontario

Since 1995, the development and maintenance of CPGs guiding the practice of cancer care in Ontario has been a joint venture between Cancer Care Ontario (CCO) and the

Program in Evidence-Based Care (PEBC) at McMaster University. The development of CPGs follows a cycle of development described by Browman et al. (2005). The guidelines are initially developed by guideline panels, working groups and medical experts. The report created includes the guideline questions, the literature search strategy, a systematic review of the literature, the consensus of the panel on the interpretation of the evidence and draft guideline recommendations. This document and a standardized feedback survey are then sent to a wide group of physicians who might find the guideline relevant (Brouwers, Graham, Hanna, Cameron, & Browman, 2004). The physicians are asked to respond to the survey questions and to provide comments, suggestions and opinion on how the guideline might be improved so that implementation into clinical practice will be facilitated. The practitioners who review the CPGs developed by the Program in Evidence-Based Care (PEBC) panel can be defined as a community of practice (CoP). Evans et al. (2006), Browman et al. (2005), and Browman and Brouwers (2009) describe some of the benefits experienced by CCO and the PEBC by including this CoP feedback into the CPG cycle:

1. Feedback improved the quality of the documents and, on occasion led to substantive changes to the CPG;
2. By requesting feedback on the CPG, physicians had to review the document and therefore were made aware of and educated about the guideline;
3. The review stimulates learning within the CoP and increases dialogue on important topics;
4. Despite rigorous adherence to the development of guidelines by experts, practitioner suggested improvements/changes were incorporated into 44% of CPGs;
5. By sending the guideline to practitioners for comment/review it provided a 'heads-up' to practitioners that a guideline was about to be finalized and released.

A recent publication (Stern et al., 2007) described the results of using oncologists 'in-the-field' to facilitate CPG development and adoption of guidelines into practice. A reduction was seen in operative mortality of pancreatic cancer and the improvement in harvesting lymph nodes in colorectal cancer. Significant improvements were made in the area of colorectal and pancreatic cancer indicators, with a mean reduction in 30 day operative

mortality from 10.2% in 1988-1996 to 4.5% in 2002-2004 and compliance with treatment guidelines increased from 27% in 1997-2000 to 69% in 2005. Therefore it was concluded that active participation of practitioners and a CoP approach were essential components to changing practice and improving quality care in surgical oncology practices in Ontario.

3.10.4 Ontario Children's Mental Health Child and Adolescent Functional Assessment Scale, (CAFAS) Initiative

Since 2000, 117 Child and Mental Health Organizations in Ontario have been mandated to adopt an electronic version of a standardized outcome measurement tool called The Child and Adolescent Functional Assessment Scale (CAFAS; Hodges, 2003). For this group of first-users of the CAFAS, Barwick et al. (2002) used a knowledge-to-action approach to develop software training, web, wiki, email and telephone support systems. They also provided face-to-face group and individual consultation and training services to facilitate implementation of the CAFAS. Recently another group of new CAFAS users were mandated to adopt the outcome tool. Barwick and colleagues (2005, 2009) used this opportunity to study the use of a community of practice (CoP) approach to implementation versus a practice as usual (PaU) approach. Both the CoP and PaU groups received standard two day training on the use of the functional assessment scale (CAFAS) in clinical practice. The CoP approach included six meetings over 11-months where additional support / training were provided. The research questions focused on the use of a CoP model to facilitate practice change and increase the use of the functional assessment scale; knowledge of the scale; satisfaction with support, as well as satisfaction with materials for implementation of the functional assessment scale relative to the practice as usual group. Although some methodological concerns have been raised about this study (Archambault et al., 2009), results generally suggest that the use of CoPs might facilitate implementation of evidence into practice. Practitioners in the CoP group demonstrated greater use of the tool in clinical practice. They also demonstrated better knowledge of the tool at the end of one year, and more satisfaction with the implementation supports than did the PaU group.

3.11 Using an integrated knowledge translation process for the development of a clinical practice guideline on outcome measures for pediatric audiology

In 2008, members of the Child Amplification Laboratory (CAL) at The National Centre for Audiology (NCA), University of Western Ontario (UWO) met with a purposely selected group of pediatric audiologists from across Canada. The overall aims for this meeting were: (1) to discuss potential interest in establishing a CoP in pediatric audiology across Canada with the aim of reducing the knowledge-to-action (KTA) gap for children receiving audiological services; and (2) to define areas of practice where these pediatric audiologists felt that there was a lack of knowledge in the treatment for children receiving audiological services. During the one and a half day meeting, the pediatric audiologists discussed the challenges to implementing evidence into clinical practice. The stated factors affecting the use of evidence in their practices, regardless of practice setting, were similar to those outlined earlier in this paper in Tables 3-2 through 3-5. The audiologists reached consensus that the area that they would like to have more knowledge and evidence for use in clinical practice was outcome measures to evaluate the auditory development and performance of children with permanent childhood hearing impairment (PCHI) aged birth to six years who wear hearing aids. They also agreed that they would like to work as a country-wide CoP and in collaboration with researchers at the NCA to develop this knowledge. In 2009, researchers in the CAL began work to develop a guideline that focused on providing pediatric audiologists with appropriate measurement tools and protocols that could be used to assess auditory development and performance outcomes for children aged birth to six years of age. The aim was to actively collaborate with the pediatric CoP using an integrated KT approach to develop this knowledge for use in clinical practice. The results of this knowledge development are discussed in the remainder of this thesis and published in Bagatto, Moodie, Malendrino et al., 2011; Bagatto, Moodie, Seewald, Bartlett, & Scollie, 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011. The final guideline called The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) version 1.0

(Bagatto, Moodie, & Scollie, 2010) has been published and is distributed worldwide primarily through the website www.dslio.com.

3.12 References

Aarons, G. A. (2006). Transformational and transactional leadership: Association with attitudes toward evidence-based practice. *Psychiatric Services, 57*, 1162-1169. doi: 10.1176/appi.ps.57.8.1162

AGREE Collaboration. (2001). Appraisal of Guidelines for Research and Evaluation: The AGREE instrument. Retrieved from: http://www.agreecollaboration.org/pdf/agreeinstrumentfinal.pdf

AGREE Collaboration Writing Group, Cluzeau, F. A., Burgers, J. S., Brouwers, M., Grol, R., Mäkelä, M., Littlejohns, P., … Hunt, C. (2003). Development and validation of an international appraisal instrument for assessing the quality of clinical practice guidelines: The AGREE project. *Quality and Safety in Health Care, 12*(1), 18-23.doi: 10.1136/qhc.12.1.18

Allee, V. (2000). Knowledge Networks and Communities of Practice. *OD Practitioner, Fall*. Retrieved from http://simplexities.com/images/VAA-KnowledgeNetworksAndCommunitiesOfPractice.pdf

American Academy of Audiology (AAA) Pediatric Amplification Guidelines (2003). Retrieved from: http://www.audiology.org/resources/documentlibrary/Documents/pedamp.pdf

American Academy of Audiology (n.d.). *The American Academy of Audiology Core Values* Retrieved from: http://www.audiology.org/about/information/Documents/CoreValuesModel.pdf

Archambault, P., Légaré, F., LeBlanc, A., Ratté, S., Magnan, M., & Pellerin, M. A. (2009). Towards an understanding of communities of practice: objective measures of mechanisms of action and impact are needed. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 18*(3), 195.

Bagatto, M. P., Scollie, S. D., Hyde, M. & Seewald, R. (2010). Protocol for the provision of amplification in the Ontario Infant hearing program. *International Journal of Audiology, 49*, S70-S79. doi: 10.3109/14992020903080751

Bagatto, M. P., Moodie, S. T., Malandrino, A. C., Richert, F. M., Clench, D. A., & Scollie, S. D. (2011). The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP). *Trends in Amplification, 15*(1), 57-76. doi: 10.1177/1084713811420304

Bagatto, M. P., Moodie, S. T., Seewald, R. C., Bartlett, D. J., & Scollie, S. D. (2011). A critical review of audiological outcome measures for infants and children. *Trends in Amplification, 15*(1), 23-33. doi: 10.1177/1084713811412056

Barwick, M. A. (2008). *Developing a Community of Practice Model for Cancer and Chronic Disease Prevention*. Toronto, ON: Canadian Partnership Against Cancer Corporation. Retrieved from: http://www.melaniebarwick.com/document/CDPAC_Final_Report_version_date_April_23_2008.pdf

Barwick, M. A., Boydell, K. M., Stasiulis, E., Ferbuson, H. B., Blase, K., & Fixsen , D. (2005). Knowledge transfer and evidence-based practice in children's mental health. Toronto, ON: Children's Mental Health Ontario. Retrieved from: http://www.kidsmentalhealth.ca/documents/KT_exec_summary.pdf

Barwick, M., Boydell, K., & Omrin, C. (2002). *A knowledge transfer infrastructure for children's mental health in Ontario: Building capacity for research and practice.* Toronto, ON: The Hospital for Sick Children. Retrieved from: http://www.melaniebarwick.com/document/Barwick_Boydell_Omrin_2002.pdf

Barwick, M., Peters, J., & Boydell, K. (2009). Getting to uptake: Do communities of practice support the implementation of evidence-based practice. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 18*(1), 16-29. Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2651208/pdf/ccap-18-1-16.pdf

Bess, F. (1995). Editorial: Evidence-Based Audiology. *American Journal of Audiology, 4*(2), 5.

Bess, F. (2000). Early Amplification for Children: Implementing Change. In R. C. Seewald (Ed.), *A Sound Foundation Through Early Amplification: Proceedings of an International Conference* (pp. 247.251). Staffa, Switzerland: Phonak AG.

Bhattacharyya, O., Reeves, S., & Zwarenstein, M. (2009). What is implementation research? Rationale, concepts and practices. *Research on Social Work Practice, 19*(5), 491-502. doi: 10.1177/1049731509335528

Brouwers, M. C., Graham, I. D., Hanna, S. E., Cameron, D. A., & Browman, G. P. (2004). Clinicians' assessments of practice guidelines in oncology: the CAPGO survey. *International Journal of Technology Assessment in Health Care, 20*(4), 421-426. doi: 10.1017.S0266462304001308

Browman, G. P., & Brouwers, M. (2009). The role of guidelines in quality improvement for cancer surgery. *Journal of Surgical Oncology, 99*(8), 467-469. doi: 10.1002/jso.21171

Browman, G. P., Levine, M. N., Mohide, E. A., Hayward, R. S., Pritchard, K. I., Gafni, A., & Laupacis, A. (1995). The practice guidelines development cycle: a conceptual tool for practice guidelines development and implementation. *Journal of Clinical Oncology, 13*(2), 502-512. Retrieved from: http://jco.ascopubs.org/content/13/2/502.abstract

Browman, G. P., Makarski, J., Robinson, P., & Brouwers, M. (2005). Practitioners as experts: The influence of practicing oncologists "in-the-field" on evidence-based guideline development. *Journal of Clinical Oncology, 23*(1), 113-119. doi: 10.1200/JCO.2005.06.179

Brown, J. S., & Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization Science, 12*(2), 198-213. Retrieved from: http://www.jstor.org/stable/3086055

Canadian Association of Speech-Language Pathologists & Audiologists (n.d.). *CASLPA Vission, Mission & Values*. Retrieved from: http://www.caslpa.ca/PDF/Mission_vision%20_values_2008_english.pdf

Canadian Institutes of Health Research (n.d.) *More About Knowledge Translation at CIHR*, Retrieved from: http://www.cihr-irsc.gc.ca/e/39033.html.

Carlson, C. L., & Plonczynski, D. J. (2008). Has the BARRIERS Scale changed nursing practice? An integrative review. *Journal of Advanced Nursing, 63*(4), 322-333. doi: 10.1111/j.1365-2648.2008.04705.x

Charlton, B. G., & Miles, A. (1998). The rise and fall of EBM. *QJM, 91*(5), 371-374. doi: 10.1093/qjmed/91.5.371

Cohen, A. M., Stavri, P. Z., & Hersh, W. R. (2004). A categorization and analysis of the criticisms of evidence-based medicine. *International Journal of Medical Informatics, 73*(35-43). doi: 10.1016/j.ijmedinf.2003.11.002

Cohen, E., Uleryk, E., Jasuja, M., & Parkin, P.C. (2007). An absence of pediatric randomized controlled trials in general medical journals, 1985-2004. *Journal of Clinical Epidemiology, 60*(2007), 118-123. doi: 10.1016/j.jclinepi.2006.03.015

College of Audiologists and Speech-Language Pathologists of Ontario (2000). Preferred practice guideline for the prescription of hearing aids to adults. Retrieved from: http://www.caslpo.com/Portals/0/ppg/preshearingaidsadults.pdf.

College of Audiologists and Speech-Language Pathologists of Ontario (2002). Preferred practice guideline for the prescription of hearing aids for children. Retrieved from: http://www.caslpo.com/Portals/0/ppg/preshearingaidschild.pdf.

Coomarasamy, A., & Khan, K. (2004). What is the evidence that postgraduate teaching in evidence based medicine changes anything? A systematic review. *BMJ, 329*, 1017. doi: 10.1136/bmj.329.7473.1017

Cox, R. M. (2005a). Evidence-based practice in audiology. *Journal of the American Academy of Audiology, 16*(7), i-ii. doi: 10.3766/jaaa.16.7.3

Cox, R. M. (2005b). Evidence-based practice in provision of amplification. *Journal of the American Academy of Audiology, 16*(7):419-438

Cummings, G. G., Estabrooks, C. A., Midodzi, W. K., Wallin, L., & Hayduk, L. (2007). Influence of organizational characteristics and context on research utilization. *Nurse Researcher, 56*, S24-39. doi: 10.1097/01.NNR.0000280629.63654.95

Damschroder, L., Aron, D., Keith, R., Kirsh, S., Alexander, J., & Lowery, J. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science, 4*:50. doi: 10.1186/1748-5908-4-50

Davies, B., & Edwards, N. (2009). Sustaining knowledge use. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 165-173). Hoboken NJ: Blackwell Publishing Ltd.

Davis, D. A., & Taylor-Vaisey, A. (1997). Translating guidelines into practice: A systematic review of theoretic concepts, practical experience and research evidence in the adoption of clinical practice guidelines. *CMAJ, 157*(4), 408-416. Retrieved from: http://ecmaj.ca/content/157/4/408.full.pdf

DiCenso, A., Cullum, N., & Ciliska, D. (1998). Implementing evidence-based nursing: some misconceptions. *Evidence Based Nursing, 1*(2), 38-40. doi: 10.1136/ebn.1.2.38

Dollaghan, C. A. (2007). *The Handbook for Evidence-Based Practice in Communication Disorders*. Baltimore, MD: Paul H. Brookes Publishing Co.

Estabrooks, C. A., Floyd, J. A., Scott-Findlay, S., O'Leary, K. A., & Gushta, M. (2003). Individual determinants of research utilization: A systematic review. *Journal of Advanced Nursing, 43*(5), 506-520. doi: 10.1046/j.1365-2648.2003.02748.x

Estabrooks, C., Squires, J., Cummings, G., Birdsell, J., & Norton, P. (2009). Development and assessment of the Alberta Context Tool. *BMC Health Services Research, 9*:234. doi: 10.1186/1472-6963-9-234

Evans, D. (2003). Hierarchy of evidence: a framework for ranking evidence evaluating healthcare interventions. *Journal of Clinical Nursing, 12*, 77-84. doi: 10.1046/j.1365-2702.2003.00662.x

Evans, W. K., Graham, I. D., Cameron, D., Mackay, J. A., & Brouwers, M. (2006). Practitioner feedback on lung cancer practice guidelines in Ontario. *Journal of Thoracic Oncology, 1*(1), 10-18.

Evidence-Based Medicine Working Group (EBMWG). (1992). Evidence-based medicine: a new approach to teaching the practice of medicine. *JAMA, 268*(17), 2420-2425. Retrieved from: http://jama.ama-assn.org/content/suppl/2008/10/08/300.15.1814.DC1/jrc110492_2420_2425.pdf

Fago, D. P. (2009). Comment: The evidence-based treatment debate: Toward a dialectical rapprochement. *Psychotherapy Theory, Research, Practice, Training, 46*(1), 15-18. doi: 10.1037/a0015134

Field, M. J., & Lohr, K. N. (1990). *Clinical Practice Guidelines: Directions for a New Program.* Washington, DC: Institute of Medicine, National Academy Press.

Francke, A. L., Smit, M. C., de Veer, A. J. E., & Mistiaen, P. (2008). Factors influencing the implementation of clinical guidelines for health care professionals: A systematic meta-review. *BMC Medical Informatics and Decision Making*, 2008, 8, 38. doi:10.1186/1472-6947-8-38

Friberger, M. G., & Falkman, G. (2011). Collaboration processes, outcomes, challenges & enablers of distributed communities of practice. *Behaviour & Information Technology,* advance online publication, doi: 10.1080/0144929X.2011.602426

Fung-Kee-Fung, M., Watters, J., Crossley, C., Goubanova, E., Abdulla, A., Stern, H., & Oliver, T.K. (2009). Regional collaborations as a tool for quality improvements in surgery: A systematic review of the literature. *Annals of Surgery, 249*(4), 565-572 doi: 10.1097/SLA.0b013e31819ec608

Gajda, R., & Koliba, C. (2007). Evaluating the imperative of intra-organizational collaborations: A school improvement perspective. *American Journal of Evaluation, 28*(1), 26-44. doi: 10.1177/1098214006296198

Gajda, R., & Koliba, C. (2008). Evaluating and improving the quality of teacher collaboration: A field-tested framework for secondary school leaders. *National Association of Secondary School Principals (NASSP) Bulletin, 92*(2), 133-154. doi: 10.1177/0192636508320990

Glasgow, R., & Emmons, K. (2007). How can we increase translation of research into practice? Types of evidence needed. *Annual Review of Public Health, 28*, 413-433. doi: 10.1146/annurev.publhealth.28.021406.144145

Graham, I. D., Beardall, S., Carter, A. O., Tetroe, J., & Davies, B. (2003). The state of the science and art of practice guidelines development, dissemination and evaluation in Canada. *Journal of Evaluation in Clinical Practice, 9*(2), 195-202. doi: 10.1046/j.1365-2753.2003.00385.x

Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map? *The Journal of Continuing Education in the Health Professions, 26*, 13-24. doi: 10.1002/chp.47

Graham, I., & Tetroe, J. (2009). Learning from the U.S. Department of Veterans Affairs quality enhancement research initiative: QUERI series. *Implementation Science,* 4:13, doi: 10.1186/1748-5908-4-13

Graham, I. D., & Tetroe, J. (2007). How to translate health research knowledge into effective health care action. *Healthcare Quarterly, 10*(3), 20-22. Retrieved from: http://www.hpme.utoronto.ca/Assets/hpme/events/hsr07/graham4.pdf

Green, L. (2001). From research to "best practices" in other settings and populations. *American Journal of Health Behavior, 25*, 165-178. Retrieved from: http://www.aahb.org/PDFs/PDFs%20RL%20Papers/01GreenPaper.pdf

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly, 82*(4), 581-629. doi: 10.1111/j.0887-378X.2004.00325.x

Grol, R., & Grimshaw, J. (2003). From best evidence to best practice: Effective implementation of change in patients' care. *Lancet, 362*, 1225-1230. doi: 10.1016/S0140-6736(03)14546-1

Grol, R., & Wensing, M. (2004). What drives change? Barriers to and incentives for achieving evidence-based practice. *The Medical Journal of Australia, 180*, S57-S60. Retrieved from: http://www.mja.com.au/public/issues/180_06_150304/gro10753_fm.pdf

Grol, R., & Wensing, M. (2005). Characteristics of successful innovations. In R. Grol, M. Wensing, & M. Eccles, *Improving Patient Care: The Implementation of Change in Clinical Practice* (pp. 60-70). Oxford: Elsevier.

Grol, R. P. T. M., Bosch, M. C., Hulscher, M. E. J. L., Eccles, M., & Wensing, M. (2007). Planning and studying improvement in patient care: The use of theoretical perspectives. *Milbank Quarterly, 85*(1), 93-138. doi: 10.1111/j.1468-0009.2007.00478.x

Harrison, M. B., Légaré, F., Graham, I. D., & Fervers, B. (2010). Adapting clinical practice guidelines to local contexts and assessing barriers to their use. *CMAJ, 182*(2), E78-E84. doi: 10.1503/cmaj.081232

Henson, C., & Beck, D. L. (2008). Do Real-Ear Measurements Make a Real Difference to Patient Outcomes? Interview with Claire Henson, Leicester Royal Infirmary, England Retrieved September 19, 2009 from http://www.audiology.org/news/interviews/Pages/20090119a.aspx

Hodges, K. (2003). *Child and Adolescent Functional Assessment Scale (3rd Ed.). .* Ypsilanti, MI: Eastern Michigan University.

House, E. R. (2003). Bush's neo-fundamentalism and the new politics of evaluation, *Studies in Education Policy and Educational Philosophy*. Retrieved from: http://upi.ped.uu.se/SITE_Docs/Doc187.pdf

Hyde, M.L. (2005a). Newborn hearing screening programs: Overview. *Journal of Otolaryngology, 34* (S2), S70-S78. Retrieved from: http://www.mountsinai.on.ca/care/infant-hearing-program/documents/hydearticle.pdf

Hyde, M. (2005b). Evidence-Based Practice, Ethics and EHDI Program Quality. In R. C. Seewald & J. Bamford (Eds.), *A Sound Foundation Through Early Amplification (Proceedings of the 3rd International Pediatric Conference)* (pp. 281-301). Basal: Phonak, AG.

Iles, R., & Davidson, M. (2006). Evidence based practice: A survey of physiotherapists' current practice. *Physiotherapy Research International, 11*(2), 93-103. doi: 10.1002/pri.328

Innvaer, S., Vist, G. E., Trommald, M., & Oxman, A. D. (2002). Health policy-makers' perceptions of their use of evidence: A systematic review. *Journal of Health Services Research & Policy, 7*, 239-244. doi; 10.1258/135581902320432778

Ismail, A. I., & Bader, J. D. (2004). Evidence-based dentistry in clinical practice. *Journal of the American Dental Association, 135*(1), 78-83. Retrieved from: http://jada.ada.org/content/135/1/78.full

Jerger, J. (2008). Editorial: Evidence-Based Practice and Individual Differences. *Journal of the American Academy of Audiology, 19*(9), 656.

Joint Committee on Infant Hearing. (2007). Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. *Pediatrics, 120*(4), 898-921.

Joint Committee on Infant Hearing, American Academy of Audiology, American Academy of Pediatrics, American Speech-Language-Hearing Association, & Directors of Speech and Hearing Programs in State Health and Welfare Agencies. (2000). Year 2000 position statement: Principles and guidelines for early hearing detection and intervention programs. *Pediatrics, 106*(4), 798-817.

Kane, R. I. (1995). Creating practice guidelines: The dangers of over-reliance on expert judgment. *The Journal of Law, Medicine & Ethics, 23*, 62-64. doi: 10.1111/j.1748-720X.1995.tb01332.x

Keefe, D. H., Bulen, J. C., Arehart, K. H., & Burns, E. M. (1993). Ear-canal impedance and reflection coefficient in human infants and adults. *The Journal of the Acoustical Society of America, 94*, 2617-2638. doi: 10.1121/1.407347

Kent, R. D. (2006). Evidence-based practice in communication disorders: Progress not perfection. *Language, Speech, and Hearing Services in Schools, 37*(4), 268-270. doi: 10.1044/0161-1461(2006/030)

King, A. (2010). The national protocol for paediatric amplification in Australia. *International Journal of Audiology, 49*, S64-S69. doi: 10.3109/14992020903329422

Kirkwood, D. H. (2010). Survey probes dispensers' views on key issues raised by *Consumer Reports*. *The Hearing Journal, 63*(5), 17-26. doi: 10.1097/01.HJ.0000373446.75826.e1

Kochkin, S., Beck, D. L., Christensen, L. A., Compton-Conley, C., Fligor, B. J., Kricos, P. B., … Turner, R. (2010). MarkeTrak VIII: The impact of the hearing healthcare professional on hearing aid user success. *Hearing Review, 17*(4):12-34. Retrieved from http://www.hearingreview.com/issues/

Koliba, C., & Gajda, R. (2009). "Communities of Practice" as an analytical construct: Implications for theory and practice. *International Journal of Public Administration, 32*(2), 97-135. doi: 10.1080/01900690802385192

Kryworuchko, J., Stacey, D., Bai, N., & Graham, I. D. (2009). Twelve years of clinical practice guideline development, dissemination and evaluation in Canada (1994 to 2005). *Implementation Science, 4:*49. doi: 10.1186/1748-5908-4-49

Landry, R. N., Amara, N., & Lamari, M. (2001). Utilization of social science research knowledge in Canada. *Research Policy, 30*(2), 333-349. doi: 10.1016/S0048-7333(00)00081-0

Lass, N. J., & Pannbacker, M. (2008). The application of evidence-based practice to nonspeech oral motor treatments. *Language Speech and Hearing Services in Schools, 39*, 408-421. doi: 10.1044/0161-1461(2008/038)

Légaré, F. (2009). Assessing barriers and facilitators to knowledge use. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 83-93). Hoboken: Blackwell Publishing Ltd.

Li, L. C., Grmishaw, J. M., Nielsen, C., Judd, M., Coyte, P. C., & Graham, I. D. (2009). Evolution of Wenger's concept of community of practice, *Implementation Science*, 4:11. doi: 10.1186/1748-5908-4-11

Lindley, G. (2006). Current hearing aid fitting protocols: Results from an on-line survey. *Audiology Today, 18*(3), 19-22.

Logan, L. R., Hickman, R. R., Harris, S. R., & Heriza, C. B. (2008). Single-subject research design: Recommendations for levels of evidence and quality rating. *Developmental Medicine & Child Neurology, 50*, 99–103. doi: 10.1111/j.1469-8749.2007.02005.x

Lomas, J. (2000). Connecting research and policy. *ISUMA: Canadian Journal of Policy Research, 1*(1), 140-144. Retrieved from: http://portals.wi.wur.nl/files/docs/ppme/lomas_e.pdf

Maher, C. G., Sherrington, C., Elkins, M., Herbert, R. D., & Moseley, A. M. (2004). Challenges for evidence-based physical therapy: accessing and interpreting high-quality evidence on therapy. *Physical Therapy, 84*, 644-654. Retrieved from: http://www.physicaltherapyjournal.com/content/84/7/644.full

Masso, M., & McCarthy, G. (2009). Literature review to identify factors that support implementation of evidence-based practice in residential care. *International Journal of Evidence Based Healthcare, 7*(2), 145-156. doi: 10.1111/j.1744-1609.2009.00132.x

McCleary, L., & Brown, G. T. (2003). Barriers to paediatric nurses' research utilization. *Journal of Advanced Nursing, 42*(4), 364-372. doi: 10.1046/j.1365-2648.2003.02628.x

McCluskley, A. (2003). Occupational therapists report a low level of knowledge, skill and involvement in evidence-based practice. *Australian Occupational Therapy Journal, 50*(1), 3-12. doi: 10.1046/j.1440-1630.2003.00303.x

McCormack, B., Kitson, A., Harvey, G., Rycroft-Malone, J., Titchen, A., & Seers, K. (2002). Getting evidence into practice: the meaning of context. *Journal of Advanced Nursing, 2002*(38), 94-104. doi: 10.1046/j.1365-2648.2002.02150.x

McWilliam, C., Kothari, A., Ward-Griffin, C., Forbes, D., Leipert, B., & South West Community Care Access Centre Home Care, C. (2009). Evolving the theory and praxis of knowledge translation through social interaction: a social phenomenological study. *Implementation Science, 4*:26. doi: 10.1186/1748-5908-4-26

Michael, B., & John, M. C. (2003). Bridging evidence-based practice and practice-based evidence: developing a rigorous and relevant knowledge for the psychological therapies. *Clinical Psychology and Psychotherapy, 10*(6), 319-327. doi: 10.1002/cpp.379

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008) From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology, 57*(4), 660-680, doi: 10.1111/j.1464-0597.2008.00341.x.

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterizing and designing behaviour change interventions. *Implementation Science, 6*:42. doi: 10.1186/1748-5908-6-42

Modernising Children's Hearing Aid Services (2007). Guidance on the use of real ear measurement to verify the fitting of digital signal processing hearing aids. Retrieved from: http://www.thebsa.org.uk/docs/RecPro/REM.pdf.

Moodie, S. T., Bagatto, M. P., Miller, L. T., Kothari, A., Seewald, R. C., & Scollie, S. D. (2011). An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). *Trends in Amplification, 15*(1), 34-56. doi: 10.1177/1084713811417634

Mueller, H. G. (2003). In the words of Shakespeare: Fitting test protocols are "more honored in the breach than in the observance". *The Hearing Journal, 56*(10), 19-26. doi: 10.1097/01.HJ.0000292915.14697.f3

Mueller, H. G., & Picou, E. M. (2010). Survey examines popularity of real-ear probe-microphone measures. *The Hearing Journal, 63*(5), 27-32. doi: 10.1097/01.HJ.0000373447.52956.25

Mullen, E. J., & Steiner, D. L. (2004). The evidence for and against evidence-based practice. *Brief Treatment and Crisis Intervention, 4*, 111-121. doi: 10.1093/brief-treatment/mhh009

Mullins, R. (2005). Survey tests members understanding of evidence-based practice. *ASHA Leader*, 4,11.

Murray, S. J., Holmes, D., & Rail, G. (2008). On the constitution and status of 'evidence' in the health sciences. *Journal of Research in Nursing, 13*(4), 272-279. doi: 10.1177/1744987108093529

Orange, J. B. (2004). Evidence-based clinical practice: A Canadian perspective. *American Journal of Speech-Language Pathology, 13*, 1264-1265. doi: 1058-0360/04/1303-0264

Pagoto, S. L., Spring, B., Coups, E. J., Mulvaney, S., Coutu, M.-F., & Ozakinci, G. (2007). Barriers and facilitators of evidence-based practice perceived by behavioral science health professionals. *Journal of Clinical Psychology, 63*(7), 695-705. doi: 10.1002/jclp.20376

Palmer, C. V. (2007). An evidence-based approach to applying hearing instrument technology in pediatrics. In R. C. Seewald & J. M. Bamford (Eds.), *A Sound Foundation Through Early Amplification: Proceedings of the fourth international conference* (pp. 121-126). Basal: Phonak, AG.

Palmer, C., Mormer, E., Ortmann, A., Byrne, D., Ye, Y., & Keogh, L. (2008). Is it REAL? Research evaluation for audiology literature. *The Hearing Journal, 61*(10), 17-28. doi: 10.1097/01.HJ.0000341755.73190.c8

Parkes, J., Hyde, C., Deeks, J., & Milne, R. (2001). Teaching critical appraisal skills in health care settings. Cochrane Database of Systematic Reviews 2001, Issue 3. Art. No.: CD001270. doi: 10.1002/14651858.CD001270.

Rinchuse, D. J., Sweitzer, E. M., Rinchuse, D. J., & Rinchuse, D. L. (2004). Understanding science and evidence-based decision making in orthodontics. *American Journal of Orthodontics and Dentofacial Orthopedics, 127*(5), 618-624. doi: 10.1016/j.ajodo.2004.09.016

Rochette, A., Korner-Bitensky, N., & Thomas, A. (2009). Changing clinicians' habits: Is this the hidden challenge to increasing best practices? *Disability and Rehabilitation, 31*(21), 1790-1794. doi: 10.1080/09638280902803773

Rogers, E.M. (2005). *Diffusion of Innovations*. 5th ed., New York: Free Press.

Rolfe, G., & Gardner, L. (2006). Towards a geology of evidence-based practice-A discussion paper. *International Journal of Nursing Studies, 43*(7), 903-913. doi: 10.1016/j.ijnurstu.2005.10.010

Rosenheck, R. (2001). Organizational process: A missing link between research and practice. *Psychiatric Services, 52*(12), 1607-1612. doi: 10.1176/appi.ps.52.12.1607

Roux, D. J., Rogers, K. H., Biggs, H. C., Ashton, P. J., & Sergeant, A. (2006). Bridging the science-management divide: Moving from unidirectional knowledge transfer to knowledge interfacing and sharing. *Ecology and Society, 11*(1), 4. Retrieved from: http://www.ecologyandsociety.org/vol11/iss1/art4/

Rycroft-Malone, J. (2004). The PARIHS framework: A framework for guiding the implementation of evidence-based practice. *Journal of Nursing Care Quality, 19*(4), 297-304. Retrieved from: http://basal-stimulation.eu/Pflege/pflege-ol/PARIHS.pdf

Rycroft-Malone, J., Kitson, A., Harvey, G., McCormack, B., Seers, K., Titchen, A., & Estabrooks, C. (2002). Ingredients for change: Revisiting a conceptual framework. *Quality and Safety in Health Care, 11*, 174-180. doi: 10.1136/qhc.11.2.174

Sackett, D. L., Rosenberg, W. M. C., Muir Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996). Evidence based medicine: what it is and what it isn't. *BMJ, 312*, 71-72. doi: 35400005264883.0050

Salisbury, M. (2008a). A framework for collaborative knowledge creation. *Knowledge Management Research and Practice, 6*, 214-224. doi: 10.1057/kmrp.2008.10

Salisbury, M. (2008b). From instructional systems design to managing the life cycle of knowledge in organizations. *Performance Improvement Quarterly, 20*(3-4), 131-145. doi: 10.1002/piq.20007

Seewald, R. C., Moodie, S. T., Scollie, S. D., & Bagatto, M. P. (2005). The DSL Method for pediatric hearing instrument fitting: Historical perspective and current issues. *Trends in Amplification, 9*(4), 145-157. doi: 10.1177/108471380500900402

Seewald, R. C., & Scollie, S. D. (1999). Infants are not average adults: Implications for audiometric testing. *The Hearing Journal, 52*(10), 64-72.

Serrat, O. (2008). *Building Communities of Practice*: Manila: Asian Development Bank. Retrieved from: http://www.adb.org/Documents/Information/Knowledge-Solutions/Building-Communities-Practice.pdf

Stahl, G. (2000). A Model of Collaborative Knowledge-Building. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Fourth International Conference of the Learning Sciences* (pp. 70-77). Mahwah, NJ: Erlbaum. Retrieved from: http://www.umich.edu/~icls/proceedings/pdf/Stahl.pdf.

Stern, H., Fung-Kee-Fung, M., Urbach, D., Smith, A., Brouwers, M., & Langer, B. (2007). *Sustainable improvement in quality indicators in Ontario's surgical oncology program (SOP).* Paper presented at the 2007 ASCO Annual Meeting Proceedings Part I. Vol 25, No. 18S (June 20 Supplement), 2007: 6638. Retrieved from: http://www.asco.org/ascov2/Meetings/Abstracts?&vmview=abst_detail_view&confID=47&abstractID=31088

Stetler, C. (2001). Updating the Stetler model of research utilization to facilitate evidence-based practice. *Nursing Outlook, 49*(6), 1-23. doi: 10.1067/mno.2001.120517

Straus, S. E. (2009). The Action Cycle. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 59). Hoboken NJ: Blackwell Publishing Ltd.

Straus, S. E., & McAlister, F. A. (2000). Evidence-based medicine: a commentary on common criticisms. *CMAJ, 163*(7), 837-841. Retrieved from: http://www.cmaj.ca/content/163/7/837.full

Straus, S. E., Tetroe, J., & Graham, I. D. (2009). Knowledge to action: what it is and what it isn't. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 3-9). Hoboken: Blackwell Publishing Ltd.

Straus, S.E., Tetroe, J., Graham, I.D., Zwarenstein, M., & Bhattacharyya, O. (2009). Monitoring knowledge use and evaluating outcomes of knowledge use. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 151-164). Hoboken: Blackwell Publishing Ltd.

Strom, K. E. (2006). The HR 2006 dispenser survey. *The Hearing Review, 13*(6), 16-39. Retrieved from: http://www.hearingreview.com/issues/articles/2006-06_11.asp

Strom, K. (2009). CR shows us a great opportunity. *The Hearing Review,* July. Retrieved from http://www.hearingreview.com/issues/articles/2009-07_05.asp.

Thompson, D. R. (2002). A response to Gary Rolfe Nurse Education Today (2002) 22(1):3-12. Faking a difference: evidence-based nursing and the illusion of diversity. *Nurse Education Today, 22*(4), 271-272 discussion 275-277. doi: 10.1054/nedt.2001.0736

Upshur, R. E., VanDenKerkhof, E. G., & Goel, V. (2001). Meaning and measurement: An inclusive model of evidence in health care. *Journal of Evaluation in Clinical Practice, 7*(2), 91-96. doi: 10.1046/j.1365-2753.2001.00279.xv

Valente, M., Abrams, H., & Benson, D., Chisolm, T., Citron, D., Hampton, D., …Sweetow, R. (2006). Summary guidelines: Audiologic management adult hearing impairment. *Audiology Today, 18*(5), 32-36. Retrieved from http://www.audiology.org/resources/audiologytoday/

Veldhuijzen, W., Ram, P., van der Weijden, T., Wassink, M., & van der Vleuten, C. (2007), Much variety and little evidence: A description of guidelines for doctor-patient communication. *Medical Education, 41*, 138–145. doi: 10.1111/j.1365-2929.2006.02667.x

Weisz, G., Cambrosio, A., Keating, P., Knaapen, L., Schlich, T., & Tournay, V. J. (2007). The emergence of clinical practice guidelines. *Milbank Quarterly, 85*(4), 691-727. doi: 10.1111/j.1468-0009.2007.00505.x

Wenger, E. (2005). Knowledge management as a doughnut: shaping your knowledge strategy through communities of practice. *Ivey Business Journal, January/February 2005*. Retrieved from: http://www.knowledgeboard.com/download/1890/Knowledge-management-as-a-doughnut.pdf.pdf

Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge.* Boston: Harvard Business School Press.

Wolf, A. W. (2009). Comment: Can clinical judgment hold its own against scientific knowledge? Comment on Zeldow (2009). *Psychotherapy Theory, Research, Practice, Training, 46*(1), 11-14. doi: 10.1037/a0015133

Wolf, K. (1999). Preparing for evidence-based speech-language pathology and audiology. *Texas Journal of Audiology and Speech Pathology, XXIII* (Spring/Summer), 69-74. Retrieved from: http://www.txsha.org/_pdf/TEJAS/VOL%20XXIII%20SPRING-SUMMER%201999.pdf#page=70

Woolf, S. H. (2000). Evidence-based medicine and practice guidelines: An overview. *Cancer Control, 7*(4), 362-367. Retrieved from: http://www.moffitt.org/CCJRoot/v7n4/pdf/dept7.pdf

Zeldow, P. B. (2009). In defense of clinical judgment, credentialed clinicians and reflective practice. *Psychotherapy Theory, Research, Practice, Training, 46*(1), 1-10. doi: 10.1037/a0015132

Zipoli, R. P., Jr., & Kennedy, M. (2005). Evidence-based practice among speech-language pathologists: Attitudes, utilization, and barriers. *American Journal of Speech-Language Pathology, 14*(3), 208-220. doi: 10.1044/1058-0360(2005/021

Chapter 4

4 An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of the University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). [2]

4.1 Background

In 2008, members of the Child Amplification Laboratory (CAL) at The National Centre for Audiology (NCA), University of Western Ontario (UWO) met with a purposely selected group of pediatric audiologists from across Canada. The overall aims for this meeting were: (1) to discuss potential interest in establishing a community of practice (CoP) in pediatric audiology across Canada with the aim of reducing the knowledge-to-action (KTA) gap for children receiving audiological services; and (2) to define areas of practice where these pediatric audiologists felt that there was a lack of knowledge in the treatment for children receiving audiological services. During the one and a half day meeting, the pediatric audiologists discussed the challenges to implementing evidence into clinical practice. The stated factors affecting the use of evidence in their practices, regardless of practice setting, were similar to those outlined earlier in this dissertation (Chapters 2 and 3) and summarized in Appendix A. The audiologists reached consensus that the area that they would like to have more knowledge and evidence for use in clinical practice was outcome measures to evaluate the auditory development and performance of young children with permanent childhood hearing impairment (PCHI) who wear hearing aids. They also agreed that they would like to work as a country-wide CoP and in collaboration with researchers at the NCA to develop this knowledge.

---

[2] A version of this chapter has been published. Moodie, S.T., Bagatto, M.P., Miller, L.T., Kothari, A., Seewald, R.C., and Scollie, S.D. (2011). An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of the University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). *Trends in Amplification, 15*(1), 34-56. doi: 10.1177/1084713811417634

4.2 Introduction

Pediatric audiologists provide infants and young children with hearing loss access to speech and other important environmental sounds through the use of well-fitted hearing aids. Evidence-based hearing aid fitting protocols currently exist, and they state that the hearing aid fitting process is comprised of appropriate assessment, selection and fitting of amplification, verification that the specified acoustical prescriptive targets have been achieved, and outcome evaluation of device effectiveness in daily life (American Academy of Audiology [AAA], 2003; Bagatto, Scollie, Hyde, & Seewald, 2010; College of Audiologists and Speech Language Pathologists of Ontario [CASLPO] 2000, 2002; King, 2010; Modernising Children's Hearing Aid Services, 2007). The outcome evaluation stage of the hearing aid fitting process within these guidelines lacks evidential, well-validated methods for appraising the auditory development and performance of young children fitted with hearing aids (Bagatto, Moodie, Seewald, Bartlett, & Scollie, 2011). This gap in evidence-based outcome measurement tools was reported by Canadian pediatric audiologists as a barrier to providing high-quality and effective services to children and their families (Chapter 3; Moodie, Kothari et al., 2011). In 2008, the Network of Pediatric Audiologists of Canada was formed and one of our first objectives was to work collaboratively in an integrated knowledge translation (*i*KT) project to develop an outcome measures guideline to evaluate the auditory development and performance of children with permanent childhood hearing impairment (PCHI) who wear hearing aids and are aged birth to six years (Bagatto, Moodie, Malendrino et al., 2011; Bagatto, Moodie, Seewald et al., 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011).

4.3 Creating knowledge to influence clinical practice

Moodie and colleagues (Chapter 3; Moodie, Kothari et al., 2011) present an overview of the knowledge-to-action (KTA) framework proposed by Graham and colleagues (2006), and described by others such as Harrison et al. (Harrison, Légaré, Graham, & Fervers, 2010), and Straus et al. (Straus, Tetroe, & Graham, 2009).

The KTA framework, as illustrated in Figure 4-1, is comprised of a knowledge creation funnel and application of knowledge cycle.

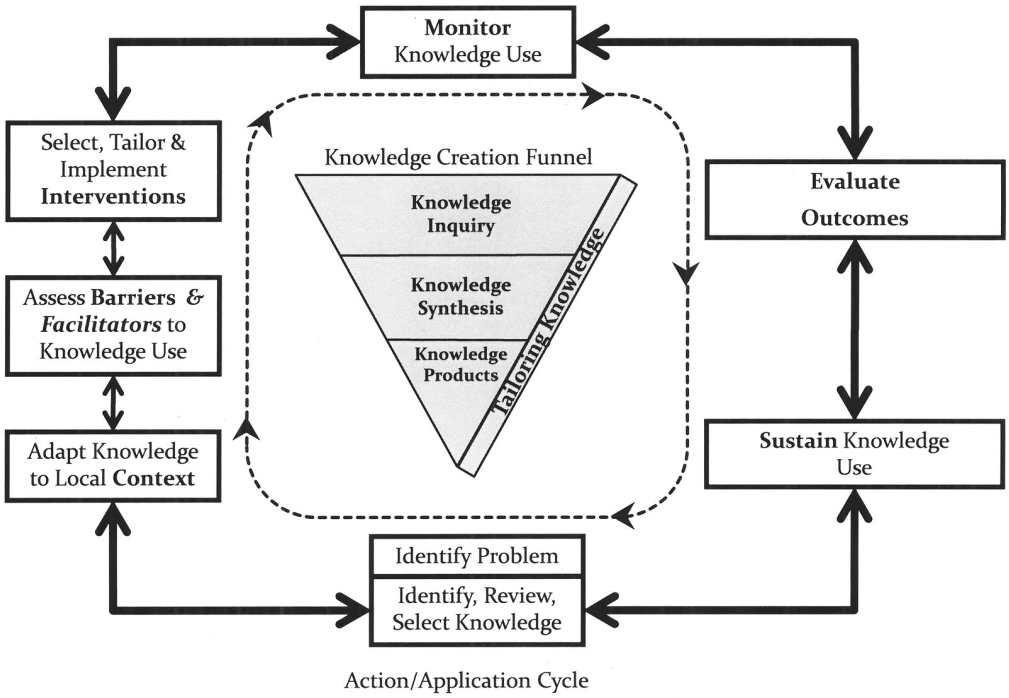


Figure 4-1: The knowledge-to-action process (Graham et al., 2006).

Adapted from "Lost in knowledge translation: Time for a map?" by I. Graham, J. Logan, M. B. Harrison, S. Straus, J. Tetroe, W. Caswell, & N. Robinson, 2006, *The Journal of Continuing Education in the Health Professions, 26,* p. 19. Copyright 2006 by John Wiley and Sons. Reprinted with permission.

The **knowledge creation funnel** guides the creation of knowledge through several important filtering phases with the end goal the development of tailored knowledge products and tools such as clinical practice guidelines (CPGs), that have the potential to be useful to end users (Harrison et al., 2010; Graham et al., 2006; Straus, Tetroe, & Graham, 2009).

Research has shown that knowledge, in the form of CPGs, protocols/procedures will not be implemented into clinical practice merely because they make sense and meet specified needs. They will require a substantive, proactive and targeted effort for knowledge translation to occur (Graham et al., 2006; Harrison, Graham, & Fervers, 2009; Harrison et al., 2010). Therefore the KTA framework includes a second, equally important component called '**the action cycle**' (Graham et al., 2006; Harrison et al., 2009; 2010).

The action cycle of the KTA process facilitates the science of clinical implementation. It identifies the activities that should be considered to guide the application of the knowledge in clinical practice including: identification of a problem that needs addressing, and identification, review and selection of knowledge relevant to addressing the problem; adaptation of the evidence/knowledge/research for use in local contexts; assessment of the barriers and facilitators to the use of the knowledge; selecting, tailoring and implementing interventions to ease and promote the use of the knowledge by clinicians; monitoring the use of knowledge; evaluation of functional and process outcomes of using the knowledge and development of methods to sustain ongoing knowledge use. The application of the knowledge cycle may occur sequentially or simultaneously as the knowledge creation phase (Graham et al., 2006).

4.4 Creating knowledge to influence clinical hearing aid outcome measures in pediatric audiology

Using the KTA process as our guide for this project, and with input from the Network audiologists, we identified a clinical practice gap in the area of hearing aid outcome evaluation for young children with hearing loss. We then completed the inquiry and synthesis stages of the knowledge creation process and compiled evidence for the selection of several evaluation measures for use when examining the auditory development and performance of children with PCHI aged birth to six years of age (Bagatto, Moodie, Seewald et al., 2011). The next steps in the KTA process are the development of a knowledge product (eg., CPG), and tailoring the CPG to facilitate implementation/uptake in clinical practice. By carefully developing and tailoring the CPG for clinical use during development, while attending to the KTA ‘application cycle’ components, we hope to release a product that will be consistently applied and adhered to in clinical practice.

Adherence to audiology CPG protocols and recommendations, like many of the health sciences professions, is an issue. In fact, in a 2003 article Mueller noted that: “There is a current trend to develop test protocols that are “evidence based.” . . . But, before we develop any new fitting guidelines, maybe we should first try to understand why there is

so little adherence to the ones we already have" (Mueller, 2003 p. 26). If adherence is defined as "the extent to which a practitioner uses prescribed interventions and avoids those that are proscribed" (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005, p. 81), then there is a need to gain a better understanding of factors associated with *implementation* of new knowledge into clinical practice to ensure we develop a CPG that is evidence-based and is more likely to be adhered to in clinical practice.

4.4.1 The dilemma of clinical implementation of evidence

The term implementation refers to the uptake of research knowledge and/or other evidence-based practice (EBP) protocols into clinical practice through a specified set of activities (for example, the predefined written procedural steps within a CPG) with the objective of changing clinical behavior and improving the quality and effectiveness of health care (Durlak & DuPre, 2008; Eccles, Armstrong, Baker, & Sibbald, 2009; Fixsen et al., 2005; Graham et al., 2006). Implementation of evidence into clinical practice is a complex process consisting of several defined functional, nonlinear and recursive stages that do not occur in isolation; they occur within the practice context and are influenced by organizational and economic factors (Damschroder et al., 2009; Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003; Estabrooks, Wallin, & Milner, 2003; Fixsen et al., 2005; Graham et al., 2006; Glasgow & Emmons, 2007; Rycroft-Malone, 2004; Rycroft-Malone et al., 2004). As discussed in Moodie, Kothari et al. (2011) and illustrated in Appendix A, analyses of the barriers to practice change indicate that obstacles to change arise at many different levels: at the level of the guideline; the individual practitioner; the context in which they work; the wider practice environment; and at the level of the patient (Damschroder et al., 2009; Estabrooks, Floyd, et al., 2003; Estabrooks , Wallin, et al., 2003; Fixsen et al., 2005; Glasgow & Emmons, 2007; Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004; Grol, Bosch, Hulscher, Eccles, & Wensing, 2007; Grol & Grimshaw, 2003; Légaré, 2009; McCormack et al., 2002; Rycroft-Malone, 2004; Rycroft-Malone et al., 2004;).

4.4.2 Acknowledging the complexity of changing clinical practice

Research in the area of implementation and changing clinical practice behavior comes from several theories including Everett Rogers' Diffusion of Innovations Theory (DoI). Diffusion, according to Rogers, can be defined as the process by which an innovation is communicated through various channels over time among members of a social system (Rogers, 2003). The spread of novel ideas can be spontaneous or planned but the four main elements by which diffusion occurs remain the same. These elements are innovation (the perceived new knowledge or product), communication channels (information sharing among people), social systems (groups through which innovation is diffused), and time (time for innovation to diffuse to all adopters). Most importantly for the KTA framework, the DoI theory suggests that the *perception* of the end-users or adopters regarding the characteristics of the knowledge which they are asked to implement helps explain different rates of implementation/adoption. End users will choose to adopt a knowledge product or innovation based on their perception of its relative advantage, compatibility, complexity, trialability and observability. Appendix B provides a description of these terms for the interested reader (Grol & Wensing, 2005; Grol, et al., 2007; Moodie, Kothari et al., 2011).

A second theory which can be used to acknowledge and better understand the complexity of changing clinical practice is the theory of planned behavior (TPB). The TPB encompasses a comprehensive list of behavior influences known to affect knowledge product/innovation utility and healthcare practitioner's behavior. According to the TPB, human behavior is primarily rational and motivated by factors that result in systematic decision-making that affects behavior (Azjen, 1991). Once defined, motivational factors can be used to predict, alter and explain individual behavior(s). The TPB states that intention (attitudes toward the behavior; beliefs about the opinions of others with respect to the behavior) and perceived control over the behavior (perceived ability to perform the behavior) directly influence the targeted behavior. Attitudes are determined by an individual's perceptions of the consequences of their behavior. Subjective norms are based on the perceptions of the preferences of others for the individual to adopt a behavior. Perceived control over the behavior is derived from the notion of self-efficacy.

Both the DoI theory and the TPB have been utilized in a number of recent implementation research studies and the constructs associated with these and other theories have been shown to be valuable in developing interventions to change behavior (Brouwers, Graham, Hanna, Cameron, & Browman, 2004; Ceccato, Ferris, Manuel, & Grimshaw, 2007; Eccles, Grimshaw et al., 2007; Eccles, Johnson et al., 2007; Francis et al., 2009; Michie, Fixsen, Grimshaw, & Eccles, 2009; Ramsay, Thomas, Croal, Grimshaw, & Eccles, 2010). Evidence has shown that the uptake of knowledge products is, at least in part, a function of the adoptors' perceptions about the attributes of the knowledge product and the process by which the knowledge is developed and translated to clinical practice (Brouwers et al., 2004; Ceccato et al., 2007; Eccles, Grimshaw et al., 2007; Eccles, Johnson et al., 2007; Francis et al., 2009; Graham et al., 2006; Légaré, 2009; Michie, Fixsen, Grimshaw, & Eccles, 2009; Ramsay, Thomas, Croal, Grimshaw, & Eccles, 2010).

Research has also shown that healthcare practitioners want their knowledge, perceptions and beliefs heard, acknowledged and implemented as part of the CPG development process (Browman & Brouwers, 2009; Browman, Makarski, Robinson, & Brouwers, 2005; Evans, Graham, Cameron, Mackay, & Brouwers, 2006; Fung-Kee-Fung et al., 2009; Stern et al., 2007). By doing this 'up front' (prior to a dissemination and/or implementation phase and during the CPG development process) we have the potential to produce more than the small to moderate implementation effects currently reported in the CPG uptake literature (Eccles et al., 2009; Hakkennes & Dodd, 2008; McCormack et al., 2002; Rycroft-Malone, 2004; Rycroft-Malone et al., 2004; 2002; Wensing, Bosch & Grol, 2009). In addition we have the opportunity to increase adherence to the CPG, ultimately affecting patient outcomes and quality of provided care.

Giving consideration to the factors associated with creating knowledge that will ultimately be utilized in practice, we worked with The Network of Audiologists of Canada throughout the knowledge creation phase to obtain objective and subjective feedback regarding the individual components that were being considered for inclusion in The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) version 1.0. We also requested their feedback regarding barriers and

facilitators to implementing outcome measures within the context in which they work. This paper will present and discuss the results of this project.

Our objective in this study was to gather information relative to end-users perceptions of the knowledge product and its use in their clinical practice to assist us to: (1) develop an implementable CPG to measure auditory-related outcomes of infants and children with PCHI; and (2) develop an appropriate understanding of barriers and facilitators that could be used for translating the desired knowledge into action in clinical practice.

4.5 Methods

4.5.1 Participants

Participants were pediatric audiologists who had been invited to be members of The Network of Pediatric Audiologists of Canada. This group initially consisted of 25 pediatric audiologists and/or pediatric audiology department managers from six provinces in Canada. Prior to the start of the project, after our initial focus group meetings, three audiologists withdrew from the Network due to job change (n=2) and career change (n=1). This left 22 pediatric audiologists to evaluate the initial components of the UWO PedAMP.

4.5.2 Ethics

This study was reviewed and approved by The University of Western Ontario's Research Ethics Board for Health Sciences Research.

4.5.3 Survey Instruments

Two questionnaires were developed for use in this project, a pre-evaluation questionnaire and a questionnaire that allowed participants to individually evaluate the components of the UWO PedAMP v1.0. Prior to sending the questionnaires to the pediatric audiologists each was reviewed by the research/authorship team which included experts in the areas of audiology, research design and methodology, and knowledge translation to ensure clarity of instructions and feasibility of the online approach to data collection.

4.5.3.1 Pre-evaluation questionnaire: Factors influencing implementation of pediatric outcome measures in clinical practice.

The pre-evaluation questionnaire was developed for use in this project as there was no previously developed, validated questionnaire that covered all of the important constructs that we wished to measure. The pre-evaluation questionnaire was completed prior to having the Network audiologists review any of the proposed components of the UWO PedAMP. It was comprised of a letter of information and 84 items for the pediatric audiologists' consideration. The items were developed based on the KTA framework and characteristics of the guideline, practitioner, and context in which pediatric audiologists work that influence the use of knowledge and evidence in clinical practice. Consideration during item development was also given to the theories of DoI and TPB. Some item wording was developed from other similar work (Brouwers et al., 2004; Ceccato et al., 2007; Eccles, Grimshaw et al., 2007; Evans et al., 2006; Francis et al., 2009; Gerrish et al., 2007; Michie et al., 2009; Quiros, Lin, & Larson, 2007; Ramsay et al., 2010; Shiffman et al., 2005). An email invitation to participate in the pre-evaluation survey was sent to the members of the Network of Pediatric Audiologists of Canada with a link to the e-survey. The online survey tool SurveyMonkey™ (www.surveymonkey.com) was used for this study. The decision to use an online survey system over a focus group was to enable pediatric audiologists from across the country to participate. Gathering the participants in one place for a focus group meeting was time and cost prohibitive. The items were presented in SurveyMonkey with clear instructions asking the respondent to indicate level of knowledge, familiarity and/or comfort using a three-point rating scale; and level of agreement or disagreement using a five-point scale. Participants were also invited to provide additional written/typed information or comments where they felt appropriate and helpful.

4.5.3.2 Questionnaire to individually evaluate the components of the UWO PedAMP v1.0.

The second questionnaire that was developed for this project was used by the pediatric audiologists to individually evaluate the components being considered for inclusion in the UWO PedAMP v1.0. This included the two auditory-related pediatric subjective outcome

evaluation tools that were being considered: The LittlEARS® Auditory Questionnaire (Tsiakpini et al., 2004), and The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Rating Scale (Ching & Hill, 2005b). The pediatric audiologists also evaluated The PEACH Diary (Ching & Hill, 2005a) in this project using the same questionnaire so that we could compare their ratings of the PEACH Rating Scale and PEACH Diary to ensure that the initial decision to include the use of the rating scale over the diary reflected the opinion of pediatric audiologists in clinical practice.

Briefly, The LittlEARS Auditory Questionnaire is a 35-item, caregiver-report, functional outcome evaluation tool that can be used to assess the auditory behaviour of infants and young children who wear hearing aids (Tsiakpini et al., 2004). The PEACH Diary and PEACH Rating scale are caregiver-report, functional outcome evaluation tools, to be used after the LittlEARS questionnaire is deemed no longer appropriate (Bagatto et al., 2011; Ching & Hill, 2005a;2005b). The PEACH Diary requires parents to observe and record frequency of 13 auditory-related behaviours over a 1 week period. The PEACH Rating Scale includes most of the scenarios of the PEACH Diary, however, instead of being asked to keep a diary, parents are asked to retrospectively report the behaviours observed over the preceding week. Additional information about how the LittlEARS and PEACH are implemented in the UWO PedAMP v1.0 can be found in Bagatto et al., 2010; and Bagatto, Moodie, Malandrino et al., 2011.

Each of the three measures identified above: (1) the LittlEARS Auditory Questionnaire, (2) the PEACH Rating Scale, and (3) the PEACH Diary were evaluated using a 41 item questionnaire. SurveyMonkey™ was used to present an overview of each measure, provide the respondent with a copy of the outcome evaluation tool and when applicable, a copy of the corresponding evaluation tool score sheet. While examining these materials, the pediatric audiologists were asked to respond to the 41 item questionnaire that aimed to assess the following: relevancy of the tool for use in clinical practice; quality, feasibility, utility, executability, acceptability, applicability, comparative value and personal motivation to use the outcome evaluation tool. The pediatric audiologists were provided with clear instructions and a five-point rating scale to indicate level of agreement or disagreement for each item statement. Participants were also provided with

a four-point rating scale to indicate level of recommendation for each of the outcome evaluation tools and asked if they would recommend it as part of preferred clinical practice, and if they would use it as part of a guideline. Participants were invited to provide additional written information or comments where they felt they would be appropriate and helpful. Some item wording was borrowed directly or was worded similarly to other work (Brouwers et al., 2004; Ceccato et al., 2007; Eccles, Grimshaw et al., 2007; Evans et al., 2006; Francis et al., 2009; Gerrish et al., 2007; Michie et al., 2009; Quiros, Lin & Larson, 2007; Ramsay et al., 2010; Shiffman et al., 2005). Participants received each of outcome evaluation tools in random order. When the participant completed their evaluation of each measure they sent an email message to the lead author (S. T. Moodie) who sent them an electronic link to the next questionnaire, until each participant had individually evaluated all of the tools. This ensured that participants did not get overwhelmed by seeing the whole package at once. Participants were asked to, but not required to, identify themselves on their evaluations. Periodic email reminders were sent to the Network of Pediatric Audiologists to encourage participants to complete all of the evaluations.

For this study, data analyses were descriptive in nature. Detailed statistical analyses were not performed on the survey data as the study aimed to provide an overall picture of pediatric audiologists' perceptions of the UWO PedAMP v1.0. The respondents were not required to provide responses to all questions; therefore the sample size may vary slightly from question to question. The content of the open-ended responses were examined to see how they enhanced our understanding of the objective measures.

4.6 Results

The years of experience as a pediatric audiologist for participants in this project ranged from less than one year to 30 years with a median of approximately 15 years.

4.6.1 Pre-Evaluation survey of factors influencing implementation of pediatric outcome measures in clinical practice.

The pre-evaluation survey was sent to 22 pediatric audiologists. Completed surveys were received from 20 providing a 91% response rate.

4.6.1.1 Current level of knowledge

Eighty percent (16/20) of the pediatric audiologists responding to this pre-evaluation survey indicated that they would rate their current level of knowledge regarding outcome measurement tools in audiology as somewhat knowledgeable. All of the respondents (100%) indicated that their current knowledge regarding auditory behaviors in infants and children aged birth to six years of age was somewhat to very knowledgeable.

4.6.1.2 How do pediatric audiologists decide which outcome evaluation tool(s) to use in practice?

The pediatric audiologist respondents decide most frequently which outcome evaluation tools to use in clinical practice based on protocols, guidelines and education programs. Table 4-1 provides a list, from most frequently cited to least frequently cited, of how they currently decide which outcome evaluation tools for hearing-related behaviors in infants and children that they use in clinical practice.

Table 4-1: List of how Canadian Network audiologists currently decide which outcome evaluation tools for auditory-related behaviors in infants and children to use in clinical practice:

1.	Information I get from provincial infant hearing program protocols
2.	Information I get from continuing education programs
3.	Information I get from preferred practice guidelines
4.	Information I learn about each patient/client as an individual
5.	Information my fellow audiologists share
6.	Information I learned during my education/training
7.	New research that I learn about at conferences
8.	Information I get from attending conferences
9.	My personal experience of caring for patients/clients over time
10.	The way that I am 'regulated' or 'told' to do it at my work setting (procedural requirement)
11.	Information I get from audiology regulatory bodies at the provincial level
12.	Articles published in peer-reviewed audiology journals
13.	Information more experienced clinical audiologists share
14.	Articles published in online journals (e.g. Audiology Online)
15.	Information I get from attending in-service workshops
16.	Information I get form the Internet
17.	My intuitions about what seems to be 'right' for the patient/client
18.	Information that I learn about from manufacturers' representatives
19.	What has worked for me in the past
20.	Information I get from product literature
21.	Information in textbooks
22.	Articles from 'trade' journals (e.g. Hearing Review)
23.	The way I have always done it
24.	What physicians/ENTs discuss with me
25.	Information I get from the media
26.	Information I get from audits of my client records
27.	Other

(in rank order from most cited to least cited measure)

4.6.1.3 Evidence-based outcome evaluation tools.

The pediatric audiologists all agreed (100%) that there is a need to use evidence-based outcome evaluation tools in practice and that although some tools do exist there is a need to develop evidence-based outcome evaluation tools to monitor auditory-related behaviors in infants and children birth to six years of age. These tools would have value for their clinical practice, and the place where they work would value having outcome evaluation tools.

4.6.1.4 What methods for monitoring auditory-related behaviors are pediatric audiologists currently using?

When asked to provide a list of their current method(s) for monitoring auditory-related behaviors in infants and children, 19 out of 20 clinicians provided responses. All clinicians used more than one means of monitoring auditory-related behaviors. The final list of 23 potential methods is provided in Table 4-2.

Table 4-2: List of outcome evaluation tools currently being used in practice to monitor auditory-related behaviours in infants and children (in no particular order).[3]

1.	Parental observation and report
2.	Consult speech-language pathologist and/or auditory-verbal therapist
3.	Aided soundfield measures, aided hearing threshold measures
4.	Use the SPLogram and evaluate proximity to prescriptive (DSL) target
5.	Aided speech perception scores in quiet and noise
6.	Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS) or Meaningful Auditory Integration Scale (MAIS).
7.	Parents' Evaluation of Aural/Oral Performance of Children (PEACH)
8.	Early Listening Function (ELF).
9.	Children's Home Inventory of Listening Difficulties (CHILD)
10.	LittlEARS Auditory Questionnaire
11.	Processing and Cognitive Enhancement (PACE)
12.	Screening Identification for Targeting Educational Risk (S.I.F.T.E.R.)
13.	Client-Oriented Scale of Improvement (COSI).
14.	Early Speech Perception Test (ESP).
15.	Glendonald Auditory Screening Procedure (GASP).
16.	Multi-Syllabic Lexical Neighborhood Test (MLNT).
17.	Word Intelligibility by Picture Identification (WIPI)
18.	WD22 word list
19.	Preschool Language Scale (PLS-4)
20.	Peabody Picture Vocabulary Test (PPVT)
21.	Ling 6 sound test
22.	tykeTalk communication checklist
23.	Toronto preschool speech & language development milestone checklist

[3] Publication references for some of the outcome evaluation tools listed above have been provided in the reference section of this paper.

Approximately half of the pediatric audiologists reported that they were somewhat familiar (53%) with the reliability and/or validity of the outcome evaluation tools they currently use in clinical practice. Approximately one-third (37%) reported that they were not familiar at all with the reliability and validity of the outcome evaluation tools they currently used.

4.6.1.5 Knowledge and selecting appropriate tools.

Only one out of the 20 pediatric audiologist respondents rated himself/herself as very comfortable in knowing what auditory-related behaviors to measure in infants and children and in selecting an appropriate evaluation tool. Most rated themselves as somewhat comfortable in: knowing what auditory -related behaviors to measure (90%); selecting appropriate evaluation tools (70%); and knowing if evaluation tools are available (80%).

When asked to rate the level of agreement they had with the statement: "I feel that the outcome evaluation tools for monitoring auditory-related behaviors in infants and children that I currently use provide me with relevant information on which to base treatment decisions", 65% of audiologists agreed that they did (13/20); 25% (5/20) provided a neutral response; and 10% (2/20) indicated that they disagreed strongly with the statement.

4.6.1.6 Barriers to implementing/utilizing tools to measure/monitor auditory-related behaviors in children birth to six years of age.

Pediatric audiologists responding to the e-survey were asked to rate their level of agreement from agree strongly to disagree strongly relative to potential barriers that might be present in implementing/utilizing tools to measure auditory-related behaviors in children birth to six years. The results are shown in Tables 4-3.

Table 4-3: Level of agreement with statements related to barriers to implementing/utilizing tools to measure auditory-related behaviors in children birth to six years.

	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
There are insufficient resources (eg. equipment) where I work to implement outcome measures for monitoring hearing-related behaviors in infants and children	0	15	85
The colleagues in my work setting are not receptive to changing practice	5	15	80
I lack the authority in my work setting to implement new measures or protocols	5	15	80
Implementation of outcome measures for monitoring hearing-related behaviors in infants and children will require too many organizational changes where I work	5	10	85
The CHILD will not be able to perform the tasks required of him/her as part of outcome measures for monitoring hearing-related behaviors in infants and children	5	25	70
I do not feel that I have the necessary technical skills to implement outcome measures for monitoring hearing-related behaviors in infants and children	0	15	85
There is not enough leadership at my workplace to implement outcome measures for monitoring hearing-related behaviors in infants and children	5	10	85
It will be too costly to set up my/our clinic to perform outcome measures for monitoring hearing-related behaviors in infants and children	0	20	80

Table 4-3 continued: Level of agreement with statements related to barriers to implementing/utilizing tools to measure auditory-related behaviors in children birth to six years.

	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The culture in my work setting is not conducive to implementing outcome measures for monitoring hearing-related behaviors in infants and children	0	15	85
There is a lack of institutional support where I work for implementing outcome measures for monitoring hearing-related behaviors in infants and children	0	15	85
The PARENT will not be able to perform the tasks required of him/her as part of outcome measures for monitoring hearing-related behaviors in infants and children	10	30	60
I do not feel confident about initiating change in my clinical practice	15	5	80
There is insufficient time where I work for me to implement outcome measures for monitoring hearing-related behaviors in infants and children	15	30	55
Outcome measures for monitoring hearing-related behaviors in infants and children are too complex to incorporate into current practice	0	20	80
I do not believe that outcome measures for monitoring hearing-related behaviors in infants and children are beneficial	0	0	100
I do not have colleagues that I could go to for support when implementing outcome measures for monitoring hearing-related behaviors in infants and children	0	10	90

Table 4-3 continued: Level of agreement with statements related to barriers to implementing/utilizing tools to measure auditory-related behaviors in children birth to six years.

	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Outcome measures for monitoring hearing-related behaviors in infants and children are too time consuming to incorporate into current practice	5	45	50
The PARENT will not take the time to perform the tasks required of him/her as part of outcome measures for monitoring hearing-related behaviors in infants and children	20	45	35
I will require training to learn to implement outcome measures for monitoring hearing-related behaviors in infants and children	70	25	5
ENTs/Physicians I work with are supportive of my implementing outcome measures for monitoring hearing-related behaviors in infants and children	55	45	0

When asked to list the top five barriers to implementing outcome evaluation tools in their practice they responded with the following (#1 being the greatest barrier):

1. There is insufficient time;
2. The parent will not take the time to perform the tasks required of him/her as part of outcome evaluation tools;
3. Outcome evaluation tools are too time-consuming to incorporate into current practice.

The following two barriers were rated equally as the fourth greatest barriers. They are:

4. The parent will not be able to perform the tasks required of him/her as part of outcome evaluation;
4. The child will not be able to perform the tasks required of him/her as part of outcome evaluation;

The fifth greatest barrier was reported as:

5. I will require training to learn to implement outcome evaluation tools.

4.6.1.7 Facilitators to implementing/utilizing tools to measure/monitor auditory-related behaviors in children birth to six years of age.

Table 4-4 provides a list of potential facilitators recommended by the audiologists to assist with implementing/utilizing tools to measure auditory-related behaviors in children birth to six years.

Table 4-4: Level of agreement with statements related to facilitators to implementing/utilizing tools to measure auditory-related behaviors in children birth to six years.

	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Making a personal commitment to implement outcome measures for monitoring hearing-related behaviours in infants and children will facilitate implementation	100	0	0
Receiving hands-on training will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	100	0	0
Getting timely feedback from expert(s) when I have a question will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	95	5	0
Having managers / admin understand the benefits of the protocol will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	95	5	0
ENTs/Physicians I work with are supportive of my implementing outcome measures for monitoring hearing-related behaviours in infants and children	50	50	0

Table 4-4 continued: Level of agreement with statements related to facilitators to implementing/utilizing tools to measure auditory-related behaviors in children birth to six years.

	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Managers / administrators where I work are supportive of my implementing outcome measures for monitoring hearing-related behaviours in infants and children	85	10	5
Flowcharts of test measures will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	80	20	0
Having trained 'leaders' onsite will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	75	15	10
Trying the protocol 'out' one measurement at a time will facilitate implementation of an entire protocol related to outcome measures for monitoring hearing-related behaviours in infants and children	75	25	0
Audiologist colleagues where I work are supportive of my implementing outcome measures for monitoring hearing-related behaviours in infants and children	75	25	0
Receiving quarterly reports on my progress will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	65	25	10
Having a DVD to watch where other clinicians have implemented the protocol will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	60	40	0
Having an expert observe me to ensure that I am performing the measurements properly will facilitate implementation of outcome measures for monitoring hearing-related behaviours in infants and children	35	50	15

The top five facilitators for implementation of outcome evaluation tools for monitoring auditory-related behaviors in infants and children recommended by the audiologists are (#1 being the greatest facilitator):

1. Receiving hands-on training;
2. Flowcharts of test measures;
3. Trying the protocol 'out' one measurement at a time;
4. Getting timely feedback from expert(s) when I have a question.

The following three facilitators were rated equally as the fifth greatest facilitator(s). They are:

5. Making a personal commitment to implement outcome evaluation tools;
5. Support from audiologist colleagues where I work; and
5. Support from managers/administrators where I work.

4.6.2 Pediatric audiologist's individual evaluation of the components of the UWO PedAMP guideline v1.0

After the pediatric audiologists had completed the pre-evaluation survey they were invited to participate in individually evaluating the three components (LittlEARS Auditory Questionnaire, the PEACH Diary, and the PEACH Rating Scale) under consideration for use in the UWO PedAMP v1.0 using a 41 item questionnaire developed for this project.

4.6.2.1 Individual evaluation of the PEACH Rating Scale versus the PEACH Diary.

Most participants agreed that the rationale and instructions for use for both the PEACH Rating Scale and PEACH Diary were stated clearly, specifically and unambiguously in the UWO PedAMP documentation. However, on approximately 75% of the questions related to quality, feasibility, utility, executability, acceptability, applicability and personal motivation to use the measure, the end-user's ranking of the PEACH Diary was poorer than the PEACH Rating Scale. Table 4-5 provides results comparing the rating of

the PEACH Rating Scale and the PEACH Diary for many relevant questions. For ease of data examination, we have collapsed the rating scale from five-point to three-point by combining the responses for the categories agree to agree strongly and disagree to disagree strongly.

Table 4-5: Individual evaluation of the PEACH Rating Scale versus the PEACH Diary.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The task related to the XXX is not too difficult for the respondent (parent) to perform	**PEACH Rating Scale**	73	13	13
	PEACH Diary	13	7	80
The task related to the XXX is not too time-consuming for the interviewer (audiologist) to perform	**PEACH Rating Scale**	80	7	13
	PEACH Diary	27	20	53
Interpretation of results for the XXX is straightforward	**PEACH Rating Scale**	64	14	21
	PEACH Diary	33	27	40
Patient results for the XXX can be reported with ease	**PEACH Rating Scale**	80	13	7
	PEACH Diary	27	33	40
Clinicians across work settings will be able to execute the XXX in a consistent way	**PEACH Rating Scale**	73	7	20
	PEACH Diary	14	36	50

Table 4-5 continued: Individual evaluation of the PEACH Rating Scale versus the PEACH Diary.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
It is clinically feasible to perform the XXX in my pediatric audiology practice	**PEACH Rating Scale**	87	7	7
	PEACH Diary	36	14	50
The XXX is suitable for routine use in pediatric audiology settings	**PEACH Rating Scale**	80	13	7
	PEACH Diary	33	13	53
The use of the XXX is likely to be supported by the manager / administrator in my work setting	**PEACH Rating Scale**	86	14	0
	PEACH Diary	50	29	21
Parents cannot perform the task required of them in the XXX	**PEACH Rating Scale**	13	13	73
	PEACH Diary	36	36	27
The XXX will take too much time for the parent to complete	**PEACH Rating Scale**	7	13	80
	PEACH Diary	73	20	7

Table 4-5 continued: Individual evaluation of the PEACH Rating Scale versus the PEACH Diary.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The XXX can be used by clinicians without the acquisition of new knowledge and skills	**PEACH Rating Scale**	73	20	7
	PEACH Diary	27	20	53
The XXX is cumbersome and inconvenient	**PEACH Rating Scale**	13	0	87
	PEACH Diary	60	20	20
The XXX reflects a more effective approach for monitoring hearing-related behaviors in infants and children than what I am currently doing in my practice	**PEACH Rating Scale**	55	33	13
	PEACH Diary	73	7	20
When applied, the XXX will result in better use of resources than current usual practice	**PEACH Rating Scale**	27	53	20
	PEACH Diary	47	40	13

An examination of the last two items shown in Table 4-5, relating to comparative value shows that participants agreed that both the PEACH Rating Scale and the PEACH Diary reflected a more effective approach for monitoring auditory-related behaviors in infants and children than what audiologists were currently doing in practice, however, their choice of the ranking 'neither agree nor disagree' for the final item, indicates that they are unsure that when applied in practice that either of these measures will result in better use of resources than what they are currently doing (53% of respondents choose neither agree

nor disagree that the PEACH Rating Scale results in better use of resources than current usual practice and 40% of respondents chose the same category for the PEACH Diary).

Finally, participants were asked three questions related to implementation of the PEACH Rating Scale and/or the PEACH Diary in clinical practice. Table 4-6 provides the results of these questions for the two measures.

Table 4-6: Implementing the PEACH Rating Scale versus the PEACH Diary in clinical practice.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	Neither Agree nor Disagree (%)	Disagree to Disagree Strongly (%)
The XXX should be implemented as part of preferred practice	PEACH Rating Scale	33	47	20
	PEACH Diary	20	33	47
Statement	**Measure**	**Level of Likelihood to Implement Measure**		
		Very Likely (%)	Moderately Likely (%)	Not Likely at All (%)
In its current form (as you have reviewed it today), if the XXX became part of a practice guideline, how likely would you be to make use of it in your daily practice?	PEACH Rating Scale	33	53	13
	PEACH Diary	33	27	40

Statement	Measure	Level of Recommendation for Use in Clinical Practice			
		Strongly Recommend (%)	Recommend (with alterations) [%]	Would not Recommend (%)	Unsure (%)
In its current form (as you have reviewed it today), would you recommend the XXX for use in clinical practice?	PEACH Rating Scale	33	47	13	7
	PEACH Diary	0	47	53	0

In terms of clinical implementation, more respondents indicated that the PEACH Diary should not be implemented as part of preferred practice. However, it should be noted that only 33% of respondents agreed that the PEACH Rating Scale should be. Many respondents (47%) indicated that they would like to see alterations made to both measures before they recommended them for clinical practice use. In its current form (as they reviewed it at the time) 53% of respondents were moderately likely to make use of the PEACH Rating Scale in daily practice if it became part of a CPG. Forty percent of respondents indicated that they would not be likely at all to use the PEACH Diary in daily practice if it became part of a CPG.

4.6.2.2 Pediatric audiologist's open-ended comments regarding the PEACH Rating Scale and the PEACH Diary.

The pediatric audiologists participating in this evaluation of the UWO PedAMP v1.0 provided open-ended comments for both the PEACH Rating Scale (n=10) and the PEACH Diary (n=8). The goal for including an open-ended comment section for this survey was to identify, isolate and explore salient points that the pediatric audiologists wanted brought to the UWO PedAMP authors' attention. Most comments were positive in nature and aimed at providing constructive input to the development of the UWO PedAMP v1.0. Comments related primarily to trialability, time, English-as-a-second language, experience, and normative data, counseling parents and suggested alterations to the measures. Positive, negative and requested revisions comments are provided below.

Positive Comments:

- *"I think that the PEACH Rating Scale will be especially good for clinicians new to pediatric hearing aid fitting."*
- *"Finally…. I also think that if parents are not convinced that the aids are helping – this would be a great tool to convince them otherwise – by comparing two assessments over time – one with aids and one without….This PEACH Rating Scale may be helpful in convincing parents to keep the hearing aids on all waking hours."*

Negative Comments:

- *"If parent completion is expected I find the instructions for each question in the PEACH Diary quite lengthy and feel that some parents may struggle with reading and comprehending the task and what they are to record. Materials in several languages would be necessary for successful implementation."*

- *"I feel that the PEACH Diary will be time consuming and planning of time frames for a visit will need to take into account completion of the PEACH. If a clinician is completing the PEACH with the parents then it could be quite time-consuming. This is also where differences in knowledge and skill set may be reflected. How effective and efficient the clinician is in administering the test will be important to successful implementation in a clinical setting."*

Suggestions for Revisions:

- *"One concern regarding the Peach is the telephone question and how this is to be interpreted for example some children use Skype/speaker phone is that considered successful use. Also what if the child has never used a phone, they would score a "0" which affects their score in a negative way."*

- *"…Materials in several languages would be necessary for successful implementation."*

- *"It would be helpful to have some clear normative data for ages and degrees of hearing loss so that we could tell parents whether their child's scores are within expected range or not, and to help clinicians know when to consider alternative intervention strategies (e.g. CI, FM)."*

- *"I think it would be a good idea to make the last blank section a place to more strongly encourage parents to write out examples and comment, instead of suggesting comments."*

4.6.2.3 Selection of the PEACH Rating Scale for inclusion in the UWO PedAMP v1.0.

Results of a comparison of the PEACH Rating Scale and the PEACH Diary indicate that the pediatric audiologists included in this sample agreed that the PEACH Rating Scale was a more clinically feasible outcome evaluation tool to implement in practice from a time, task and consistency of use perspective.

4.6.3 Individual evaluation of the LittlEARS Auditory Questionnaire and the PEACH Rating Scale.

This section will provide the results of the pediatric audiologist's individual evaluation of the LittlEARS Auditory Questionnaire (hereinafter referred to as the LittlEARS). Results from the PEACH Rating Scale evaluations have been included for comparison and discussion purposes. Most participants agreed that the rationale and instructions for use for the LittlEARS and the PEACH Rating Scale were stated clearly, specifically and unambiguously in the UWO PedAMP documentation. Respondents agreed that scoring for both measures was not difficult. On questions related to quality, feasibility, utility, executability, acceptability, applicability and personal motivation to use the measure, the end-user's ranking of the LittlEARS and the PEACH Rating Scale were positive. Table 4-7 provides results comparing both measures for many relevant questions. For ease of data examination, we have collapsed the rating scale from five-point to three-point by combining the responses for the categories agree to agree strongly and disagree to disagree strongly.

Table 4-7: Individual evaluation of the LittlEARS Auditory Questionnaire and the PEACH Rating Scale.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	Neither Agree nor Disagree (%)	Disagree to Disagree Strongly (%)
The task related to the XXX is not too difficult for the respondent (parent) to perform	**LittlEARS Auditory Questionnaire**	88	6	6
	PEACH Rating Scale	73	13	13
The task related to the XXX is not too time-consuming for the interviewer (audiologist) to perform	**LittlEARS Auditory Questionnaire**	81	0	19
	PEACH Rating Scale	80	7	13
Interpretation of results for the XXX is straightforward	**LittlEARS Auditory Questionnaire**	94	6	0
	PEACH Rating Scale	64	14	21
Patient results for the XXX can be reported with ease	**LittlEARS Auditory Questionnaire**	88	12	0
	PEACH Rating Scale	80	13	7
Clinicians across work settings will be able to execute the XXX in a consistent way	**LittlEARS Auditory Questionnaire**	100	0	0
	PEACH Rating Scale	73	7	20

Table 4-7 continued: Individual evaluation of the LittlEARS Auditory Questionnaire and the PEACH Rating Scale.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	Neither Agree nor Disagree (%)	Disagree to Disagree Strongly (%)
It is clinically feasible to perform the XXX in my pediatric audiology practice	**LittlEARS Auditory Questionnaire**	88	6	6
	PEACH Rating Scale	87	7	7
The XXX is suitable for routine use in pediatric audiology settings	**LittlEARS Auditory Questionnaire**	88	12	0
	PEACH Rating Scale	80	13	7
The use of the XXX is likely to be supported by the manager / administrator in my work setting	**LittlEARS Auditory Questionnaire**	94	6	0
	PEACH Rating Scale	86	14	0
Parents cannot perform the task required of them in the XXX	**LittlEARS Auditory Questionnaire**	6	13	81
	PEACH Rating Scale	13	13	73
The XXX will take too much time for the parent to complete	**LittlEARS Auditory Questionnaire**	0	13	87
	PEACH Rating Scale	7	13	80
The XXX can be used by clinicians without the acquisition of new knowledge and skills	**LittlEARS Auditory Questionnaire**	69	6	25
	PEACH Rating Scale	73	20	7

Table 4-7 continued: Individual evaluation of the LittlEARS Auditory Questionnaire and the PEACH Rating Scale.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The XXX is cumbersome and inconvenient	**LittlEARS Auditory Questionnaire**	0	19	81
	PEACH Rating Scale	13	0	87
The XXX reflects a more effective approach for monitoring hearing-related behaviors in infants and children than what I am currently doing in my practice	**LittlEARS Auditory Questionnaire**	75	19	6
	PEACH Rating Scale	53	33	13
When applied, the XXX will result in better use of resources than current usual practice	**LittlEARS Auditory Questionnaire**	75	13	13
	PEACH Rating Scale	27	53	20

An examination of the last two items shown in Table 4-7 related to comparative value shows that participants agreed that the LittlEARS reflected a more effective approach for monitoring auditory-related behaviors in infants and children than what they were currently doing in practice, however, their choice of the ranking 'neither agree nor disagree', more frequently for the PEACH Rating Scale for the final item, indicates that they are unsure that when applied in practice that the PEACH Rating Scale will result in better use of resources than what they are currently doing. Finally, participants were asked three questions related to implementation of the LittlEARS and the PEACH Rating Scale in clinical practice. Table 4-8 provides the results of these questions for both measures.

Table 4-8: Implementing the LittlEARS and the PEACH Rating Scale in clinical practice.

Statement	Measure	Level of Agreement		
		Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The XXX should be implemented as part of preferred practice	**LittlEARS**	75	19	6
	PEACH Rating Scale	33	47	20
Statement	**Measure**	**Level of Likelihood to Implement Measure**		
		Very Likely (%)	**Moderately Likely (%)**	**Not Likely at All (%)**
In its current form (as you have reviewed it today), if the XXX became part of a practice guideline, how likely would you be to make use of it in your daily practice?	**LittlEARS**	56	38	6
	PEACH Rating Scale	33	53	13

Statement	Measure	Level of Recommendation for Use in Clinical Practice			
		Strongly Recommend (%)	**Recommend (with alterations) [%]**	**Would not Recommend (%)**	**Unsure (%)**
In its current form (as you have reviewed it today), would you recommend the XXX for use in clinical practice?	**LittlEARS**	63	19	12	6
	PEACH Rating Scale	33	47	13	7

In terms of clinical implementation, most respondents agreed to strongly agreed that the LittlEARS should be implemented as part of preferred practice (75% and 62% respectively), while only 33% agreed to strongly agreed that the PEACH Rating Scale should be implemented as part of preferred practice. In its current form (as they reviewed it at the time) 85% or more of the respondents indicated that they were moderately to very likely to make use of the LittlEARS and the PEACH Rating Scale in daily practice if they became part of a CPG. However, approximately half of the audiologists indicated that they would like to see alterations made to the PEACH Rating Scale before they recommended it for clinical practice use. Sixty-three percent of respondents stated that they would recommend the LittlEARS in its current form for use in clinical practice.

4.6.3.1 Pediatric audiologist's open-ended comments regarding LittlEARS and the PEACH Rating Scale.

The pediatric audiologists participating in this evaluation of the UWO PedAMP v1.0 provided open-ended subjective comments for the LittlEARS and the PEACH Rating Scale. The goal for including an open-ended comment section for this survey was to identify, isolate and explore salient points that the pediatric audiologists wanted brought to the UWO PedAMP authors' attention. Most comments were positive in nature and aimed at providing constructive input to the development of the UWO PedAMP v1.0. Comments related primarily to comparative value, procedural issues, necessary translations, language level, counseling parents and suggested alterations to the measures. Examples for the LittlEARS are provided below. Comments related to the PEACH Rating Scale were provided in the previous section of this paper.

Positive Comments:

- *"The items listed in the LittlEARS questionnaire are very descriptive and provide both accurate and straightforward information regarding the child's communication development….The items listed in the questionnaire are easy and simple enough for parents to complete and observe in their child; thus aiding as a counseling tool…."*

- *"This tool allows for measurement of even small gains in auditory skills. By highlighting gains a parent can feel proud of all their hard work. I see this tool being used with very young children. However I mainly see that I would use it with children who are hearing impaired who are low functioning where it is otherwise not possible to see gain".*

Negative Comments:

- *"The LittlEARS questions only cover a limited number of auditory responses a child may display….The disadvantage that it poses is that all questions are closed set and by being limited to questions that only depict certain scenarios, an infant's true range of auditory behaviors may not be accurately portrayed."*

- *"The process is clinically redundant. However if the concept is simply to document whether the child is doing as they should, given age etc, auditorily under an amplified condition, then it should be divided off into age related sections. If the child is doing as expected in their given age range...then done, there is no need to determine if they are doing "better" than expected...this information can be provided by the relevant therapist or teacher. If doing "worse" than expected yes certainly appropriate review should be conducted and referrals and/or counseling conducted".*

Suggested Revisions:

- *"There is no need to look for 6 "no's " in a row, when you are already well above the child's age range."*

- *"… Additionally it would be nice if there were norms on English speakers as well."*

- *"It would be interesting to see what the reports would look like from parents with children with auditory neuropathy spectrum disorder."*

4.7 Discussion

Clinicians wish to make decisions on which outcome evaluation tools to use in clinical practice based on the best available evidence. The Network of Pediatric Audiologists of Canada clinicians unanimously agreed that there is a need to use evidence-based outcome evaluation tools in practice. They currently attempt to obtain this evidence by using measures based on information that they obtain from provincially-developed protocols and preferred practice guidelines. They also wish to integrate and balance information based on evidence with their clinical experience and by valuing their young patients and their families as individuals.

All of the invited Network of Pediatric Audiologists of Canada audiologists were motivated to participate in a project to evaluate the components of the UWO PedAMP. This provided them with an opportunity to collaborate and negotiate with researchers during the knowledge creation process to ensure that the knowledge product (e.g., CPG) that was being created was tailored in such a way to promote use and adherence within their clinical practice setting.

Most of the Canadian Network audiologists are knowledgeable and comfortable with knowing what auditory-related behaviors to measure, feel that they can select appropriate measurement tools but some do not feel that the measures they currently use provide them with relevant information on which to base treatment decisions. As shown in Table 4-2, numerous measures are currently being used in clinical practice to evaluate the auditory development and performance of young children with PCHI. The data presented in Table 4-2 indicates that there appears to be no consistent battery of outcome evaluation tools being used. Many of the tools being used would not be administered during routine audiological appointments and would be administered by other professionals associated with their audiology department (for example, auditory-verbal therapists and/or speech-language pathologists). Some of the measures listed by respondents would be more useful with children six years of age or older (eg., S.I.F.T.E.R., PACE, ESP, GASP, MLNT, WIPI, WD22 word list) while others primarily assess speech and language development

(eg., PLS-4, PPVT, tykeTalk communication checklist, Toronto preschool speech and language development milestone checklist). For those on the list that are appropriate for use with children from birth to six years of age, they have not been included in the UWO PedAMP v1.0 because of one or more factors including: they did not have normative data gathered from large-scale studies, they were lengthy, or their administration/respondent burden was high (see Bagatto, Moodie, Seewald et al., 2011).

Throughout this project, we defined knowledge creation as the social collaboration and negotiation of different perspectives, including personal experience, empirical evidence and logical deduction that results in acceptance of a common result (Brown & Duguid, Nutley, Walter, & Davies, 2003; Stahl, 2000). This definition can be seen in practice in the decision to use the PEACH Rating Scale over the PEACH Diary within the UWO PedAMP v1.0. If one were to make a decision on which outcome evaluation tool to use in practice based on the highest ranking or quality of evidence, the PEACH Diary would be used. Administration of the PEACH Diary required parents to observe and document a list of auditory related behaviors over a one-week period. The PEACH Rating Scale which is a paper/pencil task where the parents are asked to retrospectively (during the prior week) rate the presence/absence of auditory related behaviors, provided a tool reduced in respondent and administrative burden compared to the PEACH Diary. The Network of Pediatric Audiologists of Canada provided us with an opportunity to have clinicians'-in-the-field evaluate both formats of the PEACH (the diary and rating scale). One of the benefits of collaboration with this CoP is that the Network audiologists, regardless of the context in which they worked, made it very clear that they found the PEACH Rating Scale to be a more clinically feasible outcome evaluation tool to include in the UWO PedAMP. They indicated that the PEACH Rating Scale was less difficult to score and interpret; less difficult and time consuming for the caregiver to perform; less time consuming for the audiologist; easier to use the results in reports; more clinically feasible and suitable to use; would have more support and acceptance for use in their workplace setting; would require less development of new skills and knowledge to be able to use; and was more practical to implement**.** More audiologists indicated that they were likely to use the PEACH Rating Scale in daily practice over the PEACH Diary if it became part of a practice guideline. This made the authors of the UWO PedAMP v1.0

decision to include the PEACH Rating Scale very straightforward and also provided evidence for the choice for this inclusion.

Results show that the Network of Pediatric Audiologists of Canada found the LittlEARS and the PEACH Rating Scale to be clinically feasible to perform in a consistent fashion and that their use in practice would likely be supported by other clinicians and administration/managers within their work context. Approximately 90% of the Network audiologists indicated that they would moderately to very likely implement the measures in their daily practice. This would contribute to the objective of developing a guideline that would produce more than the small to moderate implementation effects currently reported in the CPG uptake literature (Eccles et al., 2009; Hakkennes & Dodd, 2008; McCormack et al., 2002; Rycroft-Malone, 2004; Rycroft-Malone et al., 2004; Rycroft-Malone et al., 2002; Wensing et al., 2009).

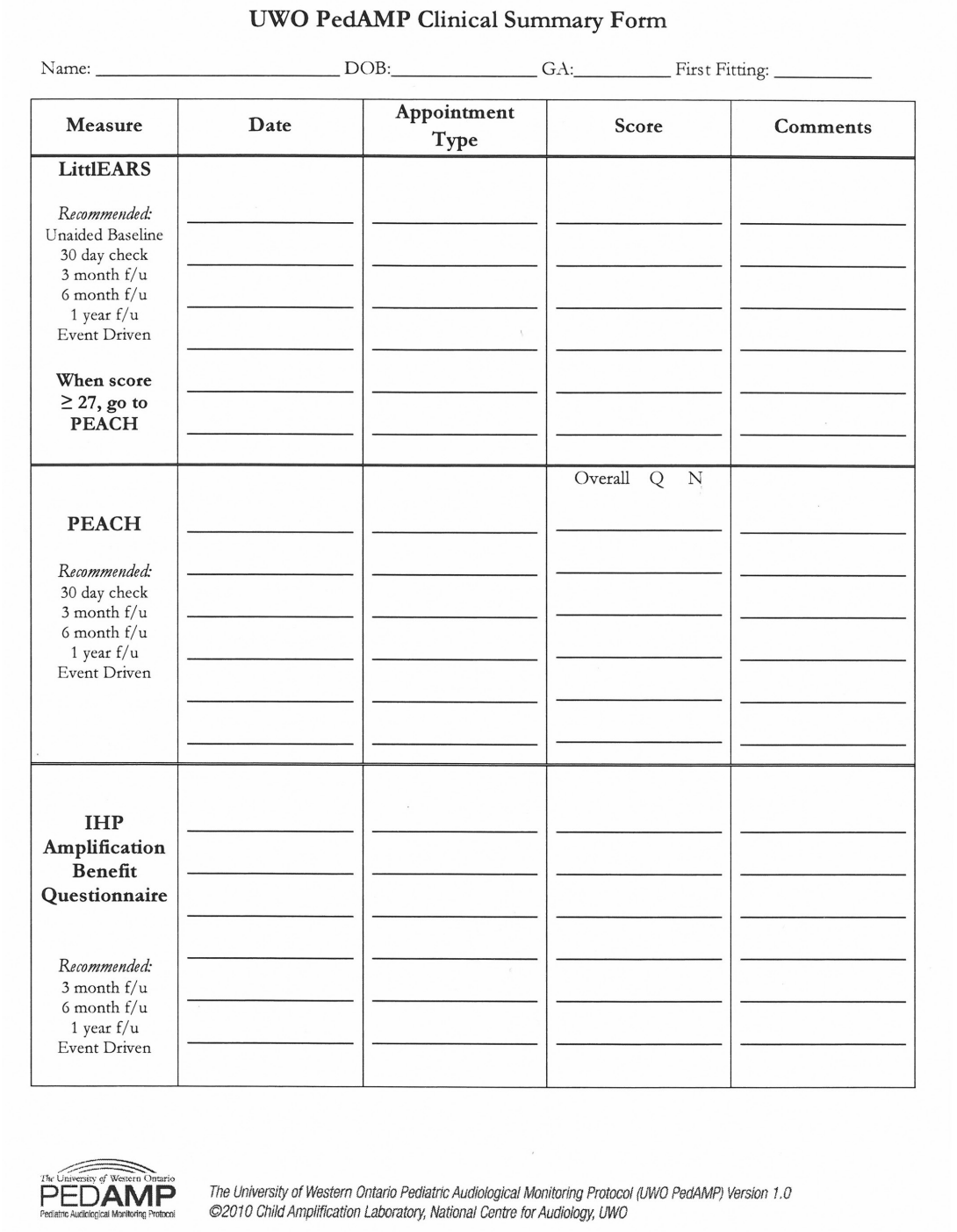
The KTA framework outlines the activities that may be needed for the application of knowledge in clinical practice (Graham et al., 2006; Graham & Tetroe, 2007; Harrison et al., 2009; 2010; Straus, 2009; Straus et al., 2009). One of the primary steps in the application cycle is the adaptation of the evidence/knowledge/research to the local context. In the development of the UWO PedAMP, the early feedback from the pediatric audiologists provided insight to the potential adaptations that might be necessary. Many of the audiologists work in large urban multi-cultural centers. They noted that having an outcome evaluation tool like the LittlEARS that has been translated into many different languages was beneficial for clinical use and might be more easily implemented into clinical practice. Many noted that implementation of the PEACH Rating Scale could be more problematic because it may have to be administered interview style for parents who did not read English or Canadian French. They also provided input to the researchers on the requirement within some practice contexts to have materials for clinical use that were as close to a grade four reading level as possible. The CAL researchers have worked with audiologists to derive an initial list of languages for the PEACH Rating Scale translation and will continue to work to improve the reading levels of as many materials to closely approximate a grade four reading level.

The Network of Pediatric Audiologists of Canada also expressed a need for tools which could be used to verify and document an appropriately fitted hearing aid was provided to the child prior to moving to the outcome evaluation stage of the hearing aid fitting process. This CoP worked together to develop normative data for fit to Desired Sensation Level (DSL) Method version 5.0 targets that can be used to evaluate typical hearing aid fittings for children as a function of hearing loss (Bagatto, Moodie, Malandrino et al., 2011; Moodie, 2009; 2010). This Aided Speech Intelligibility Index (SII) Normative Values Worksheet is included in the released version of the UWO PedAMP (Bagatto, Moodie, & Scollie, 2010).

Another component of the application cycle within the KTA framework is the assessment of barriers to using the knowledge in clinical practice. Some of the Network of Pediatric Audiologists of Canada expressed concern that the UWO PedAMP might require some need for new knowledge/skill development prior to clinical implementation. During the development of the UWO PedAMP training materials (manual, case examples, etc.) we tried to remember that novice audiologists will likely have different expertise and training requirements than more experienced clinicians (Salisbury, 2008a; 2008b). Therefore we developed case examples that increase in difficulty as part of the UWO PedAMP. The audiologists also indicated concern that parents might not be able to perform the tasks required of the measures in a timely fashion. Some were concerned with the retrospective nature of the PEACH Rating Scale. Some of these barriers can be addressed prior to implementation (development of knowledge/skills) and some will need to be addressed as the implementation phase of the UWO PedAMP develops.

The knowledge-to-action framework indicates that use of the knowledge within clinical practice settings can be facilitated during the application cycle by selecting, tailoring and implementing interventions to promote clinical uptake of the knowledge (Graham et al., 2006; Graham & Tetroe, 2007; Harrison et al., 2009; 2010; Straus, 2009; Straus, Tetroe, & Graham, 2009, 2011). With this in mind, written input from the pediatric audiologists was solicited and provided by several who tried the components of the UWO PedAMP out in clinical practice. Their input led to several important changes prior to finalizing the UWO PedAMP for wide-spread release including: the development of the clinical

summary form shown in Figure 4-2; darkening of lines and shaded regions on the score sheets to make visualization easier; development of a percentage (%age) look-up table for the PEACH Rating Scale so that clinicians would not have to use a calculator to determine percentage correct scores; development of a PEACH score sheet so that performance ranges are clearly visible and individual scores can be interpreted (Figure 4-3); and the ability to track several appointments on one PEACH Rating Scale score sheet (as indicated by Time 1, Time 2, Time 3 [T1, T2, T3] areas shown on Figure 4-3) so that performance over time was more easily visualized.



UWO PedAMP Clinical Summary Form

Name: _____ DOB:_____ GA:_____ First Fitting: _____

Measure	Date	Appointment Type	Score	Comments
LittlEARS *Recommended:* Unaided Baseline 30 day check 3 month f/u 6 month f/u 1 year f/u Event Driven **When score ≥ 27, go to PEACH**				
PEACH *Recommended:* 30 day check 3 month f/u 6 month f/u 1 year f/u Event Driven			Overall Q N	
IHP Amplification Benefit Questionnaire *Recommended:* 3 month f/u 6 month f/u 1 year f/u Event Driven				

The University of Western Ontario PEDAMP Pediatric Audiological Monitoring Protocol

The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) Version 1.0
©2010 Child Amplification Laboratory, National Centre for Audiology, UWO

Figure 4-2: The Clinical Summary Form developed for use in the UWO PedAMP v1.0.

From *"The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) Version 1.0* by M. Bagatto, S. Moodie and S. Scollie. Copyright 2010 by Child Amplification Laboratory, National Centre for Audiology, Univ. of Western Ontario. Reprinted with permission.

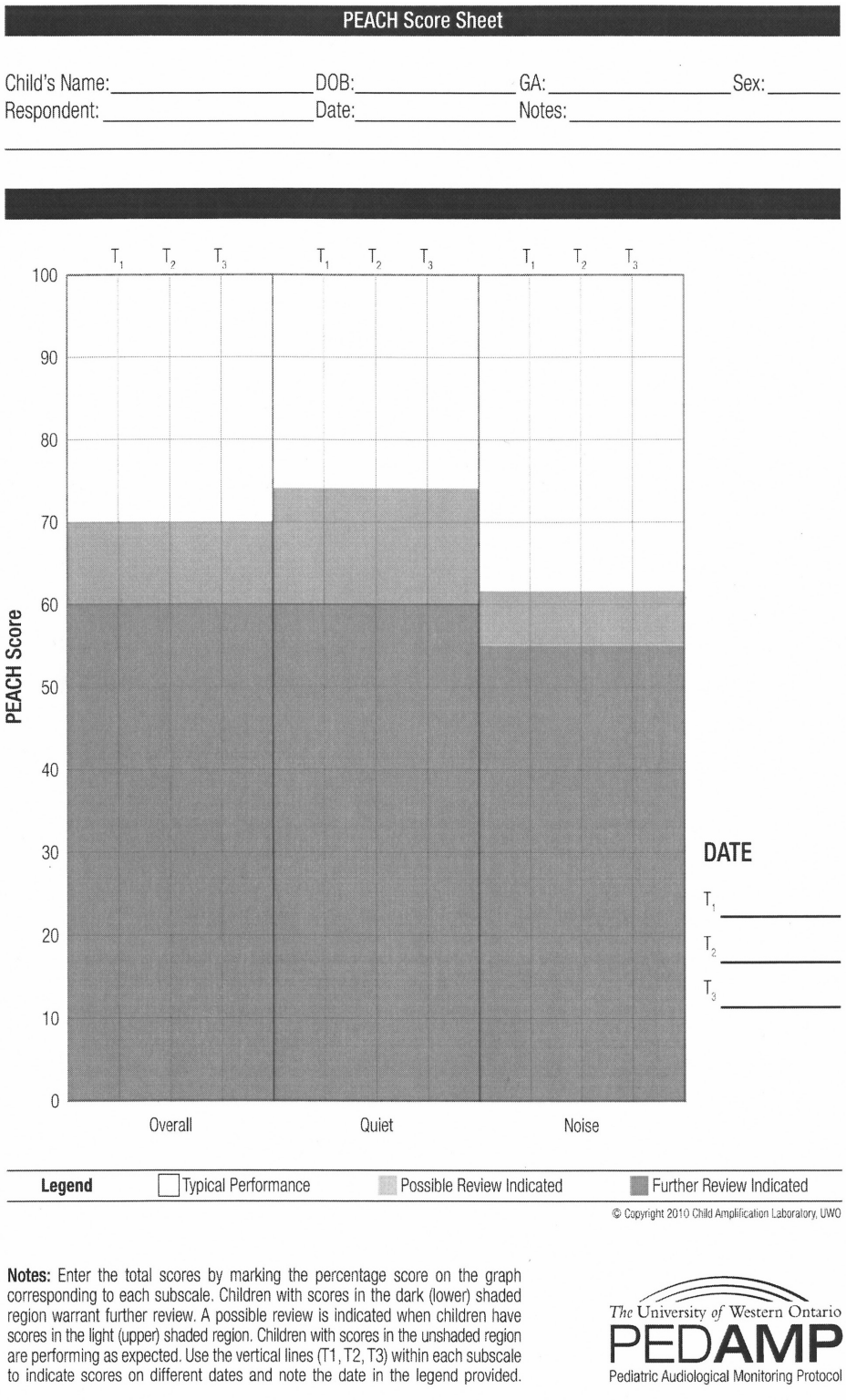


Figure 4-3: The PEACH Score Sheet developed for use in the UWO PedAMP v1.0.

From *"The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) Version 1.0* by M. Bagatto, S. Moodie and S. Scollie. Copyright 2010 by Child Amplification Laboratory, National Centre for Audiology, Univ. of Western Ontario. Reprinted with permission.

In addition, questions that the pediatric audiologists asked that related to clinical implementation while they evaluated each of the components of the UWO PedAMP were used to develop case examples and frequently-asked-questions for each section of the UWO PedAMP manual. The research team hoped that by doing this we anticipated the questions that would most frequently be raised and provided answers/solutions during the training/learning process resulting in more clinical confidence and increase perceived self-efficacy in implementing the measures in clinical practice.

The largest barrier reported by the audiologists to implementing outcome measures into clinical practice was time. An examination of health sciences research literature on barriers to implementing evidence into clinical practice reveals that 'lack of time' is a major limitation cited by most clinicians regardless of profession (Harrison et al., 2010; Iles & Davidson, 2006; Maher, Sherrington, Elkins, Herbert, & Moseley, 2004; McCleary & Brown, 2003; McCluskley, 2003; Mullins, 2005; Zipoli & Kennedy, 2005). The Network audiologists were also concerned that parents might not take the time to perform the outcome measurement tasks required of them as part of the UWO PedAMP. This concern might also reflect their clinical expertise because they know that children with hearing loss are often born with other complex health issues which place a large time burden on caregivers. Pediatric audiologists who tried the UWO PedAMP out prior to the final released version indicated that on average it would take them about 15 minutes of extra appointment time to administer the components of the UWO PedAMP. They were concerned that they would run into appointment time issues especially while they were gaining confidence and learning how to administer/interpret the outcome measures. The Network of Pediatric Audiologists of Canada were concerned that the increasing amount of paperwork and time involved in performing these outcome evaluation tools over what they are currently doing in practice may mean that they are spending additional time that they may not receive remuneration for. An additional barrier noted to clinical implementation of the LittlEARS is that it is copyrighted material. Copies must be purchased directly from the Med-El Medical Electronics Co. and daily clinical use could become expensive.

The Network of Pediatric Audiologists of Canada respondents reported that clinical implementation of the outcome evaluation tools would be facilitated primarily by support from administration/managers, colleagues at work and UWO PedAMP 'experts'. They wanted visual flowcharts to summarize when the outcome evaluation tools should be conducted, appropriate normative data to assist in interpretation of scores and time to try the measures out independent of each other. The UWO PedAMP includes many flowchart-like tools to facilitate clinical implementation, including a chart that shows which measures should be conducted at which appointment. This outcome evaluation tool by appointment grid is shown in Figure 4-4.

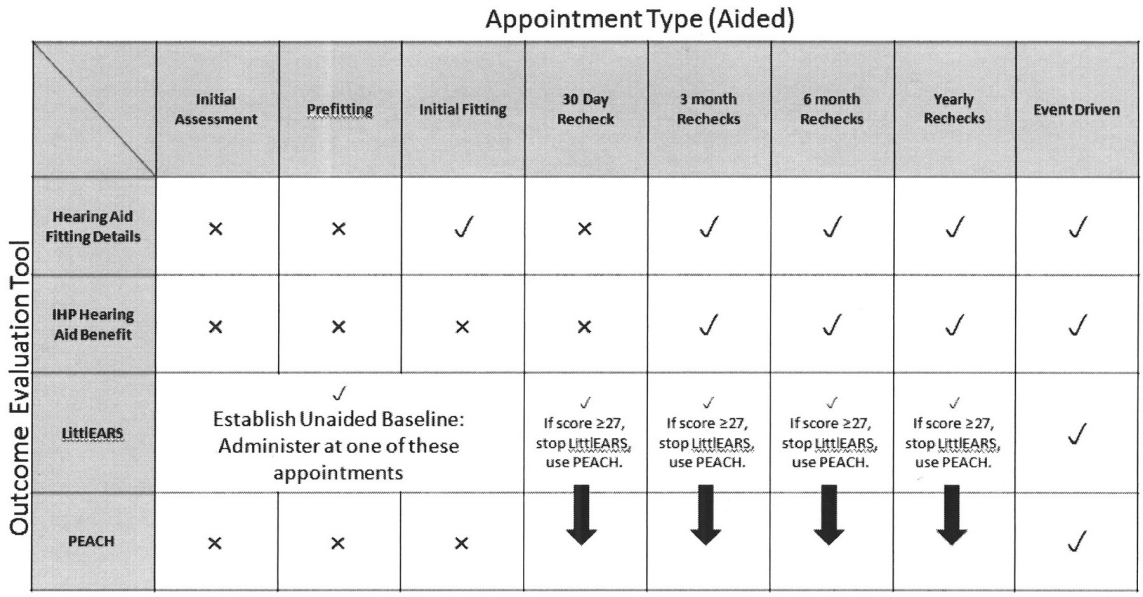


Figure 4-4: The Outcome Evaluation Tool by Appointment reminder grid developed for use in the UWO PedAMP v1.0.

From *"The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) version 1.0* by M. Bagatto, S. Moodie and S. Scollie. Copyright 2010 by Child Amplification Laboratory, National Centre for Audiology, Univ. of Western Ontario. Reprinted with permission.

It has been our experience throughout the development of the Desired Sensation Level (DSL) Method for hearing aid selection and fitting developed in our laboratory (www.dslio.com), that the translation of knowledge from the research laboratory to clinical practice is facilitated by hands-on training. Hands-on training was recommended as the top facilitator by the Network audiologists. Based partially on these results, the developers of the UWO PedAMP could anticipate 'up-front' that there would be a large demand placed on the CAL researchers' time for hands-on training. Therefore we developed a training DVD that will accompany the UWO PedAMP manual. This DVD was developed based on the successful live training sessions that Dr. Bagatto provided to the Ontario Infant Hearing Program (OIHP) audiologists. It essentially duplicates the live training sessions. In addition, copies of appropriate materials such as the PEACH score sheet, clinical summary forms and the appointment type by outcome evaluation tool administration grid are provided on the DVD for clinicians to access and print as needed. To respond to the requests for timely feedback from experts when a clinician has a question, the CAL researchers are working to add a page to the DSL website (www.dslio.com) where clinicians can look up frequently-asked questions and/or pose a question for answer and obtain updated forms and new information relative to the UWO PedAMP as it evolves over time.

One of the interesting findings emerging from this study is that regardless of the availability of resources, the ability for the pediatric audiologists to change practice if they choose to, the expertise and knowledge of the audiologists, the good leadership, and the culture and institutional support in the contexts in which they work, approximately ten percent of the Network audiologists indicated that they would not likely implement the evaluation tools in their daily practice. These statistics underscore the importance of measures of perceived comparative value, and of viewing knowledge translation as a dynamic, iterative and collaborative process. We asked the audiologists to provide reasons if they selected 'not likely' as their response. Overall, subjectively, it appears that relative advantage or utility/comparative value was a primary reason why they might not implement the outcome evaluation tools in daily practice. Relative advantage or comparative value relates to the new measure(s) that are part of the guideline being better

than existing or alternative methods. For example, some of the members of the Network of Pediatric Audiologists of Canada indicated that they would not likely implement the measures in daily practice because:

- *"Much of the information requested would generally be covered by pediatric audiologists in their standard practice format, i.e., the audiologist should routinely be asking questions around hearing instrument use and auditory behavior and speech development. Formal assessment of auditory verbal and/or language acquisition should occur, however, there are support personnel/professionals who will, and do, do this on a routine basis….(auditory/verbal therapists and speech-language-pathologists). In general their observations and assessments will be as thorough as and/or more so than what would be accomplished and/or could be accomplished in the audiologist's office. Consequently questionnaires like the PEACH or similar to it, may in fact be redundant in terms of the assessment and treatment process."* and
- *"The questions/topics/ideas covered I already routinely cover with my patients so I do not see value in adding this tool. Also asking the same questions every time the same way does not necessarily uncover other issues that need to be addressed/worked on."*

It is our hope by examining both the quantitative and qualitative information gathered in this study and implementing suggestions to alter the UWO PedAMP and address barriers and facilitators to use we have increased the number of Network of Pediatric Audiologists of Canada audiologists who will 'very likely' implement the UWO PedAMP in their daily practice.

4.8 Study Limitations

This project has several limitations. Although every effort was made to develop survey questionnaires that covered all the constructs delineated in research articles that examined the implementation issues associated with translating knowledge into clinical practice action, the psychometric properties of the questionnaires were not investigated prior to their use. A psychometric evaluation may have led to revision of some of the questions

included in the questionnaire. Richer qualitative information might have been obtained using a face-to-face or telephone interview format. In addition, qualitative data gathering may have provided participants with a narrative voice, providing a more indepth understanding of the process within the context in which these pediatric audiologists worked. By purposefully sampling the participants and/or participant sites for this study, we may have introduced several types of bias. Although most respondents provided both quantitative and written responses reflecting their opinions regarding the outcome measurement tools, and provided suggestions for modifications, revisions and additions; it should be noted that some responses may have been biased toward what participants believed were socially desirable answers. Pediatric audiology practice in Canada, for the most part, follows similar hearing assessment, device selection and prescription and verification procedures throughout most Provinces. Canada is the home of the National Centre for Audiology (NCA) at the University of Western Ontario (UWO) that houses the largest training program for audiologists in the country. Many of the Network audiologists were trained at UWO or at other Canadian Universities that use the DSL Method as the primary method for the selection and fitting of hearing aids for infants and young children. Findings from this study may not generalize to other countries or reflect the views of a more general group of pediatric audiologists. Finally, use of the UWO PedAMP is being mandated for use by audiologists within the Ontario Infant Hearing Program (OIHP). Ontario-based audiologists who participated in this project knew that this outcomes battery would have to be implemented within their practice; therefore this could have impacted their ratings of the measures and their written input. An examination of results indicates that all of the audiologists, regardless of the fact some would be mandated to use the measures, and others would not, wanted their knowledge, experience, perceptions and beliefs heard and acknowledged as part of the UWO PedAMP development process. They knew and appreciated that they had an opportunity to tailor the UWO PedAMP for use in clinical practice.

4.9 Conclusion

Our objective in this work was to use the KTA framework and a CoP comprised of pediatric audiologists to develop a clinical practice guideline aimed at systematically

evaluating auditory-related outcomes of infants and young children with PCHI who may or may not wear hearing aids. The end result of this collaboration was the creation of a knowledge product, the UWO PedAMP v1.0, which has the potential to be useful to audiologists' in-the-field and the children and families they serve. It is the hope of the developers of the UWO PedAMP that by attending to many of the components of the KTA framework 'up front' during the development process we have the potential to produce more than the small to moderate implementation effects currently reported in the CPG uptake literature (Eccles et al., 2009; Hakkennes & Dodd, 2008; McCormack et al., 2002; Rycroft-Malone, 2004; Rycroft-Malone et al., 2004; Rycroft-Malone et al., 2002; Wensing et al., 2009). In addition, we see the opportunity to potentially increase adherence to the CPG, ultimately affecting patient outcomes and quality of provided care.

Future research should focus on an evaluation of the full release-version of the UWO PedAMP v1.0 and training DVD by the Network of Pediatric Audiologists of Canada audiologists; and an evaluation of the UWO PedAMP v1.0 and training DVD by a larger, more diverse sample of pediatric audiologists. In addition, because not all of the Network audiologists were required to try the UWO PedAMP out in practice prior to offering their comments regarding clinical implementation, future research could consider an implementation study of the UWO PedAMP. Implementation research is a young scientific field studying methods, strategies and interventions that affect change in evidence-based practice behavior in individuals and the complex organizations in which they work (Eccles et al., 2009). Clinical outcomes are beneficial because they provide important information about the effectiveness of clinical interventions. Implementation outcomes are beneficial because they provide us with information about whether a clinical intervention program exists in the first place (Gilliam, Ripple, Zigler, & Leiter, 2000). Implementation studies may provide us with an understanding of why we have adherence issues (Mueller, 2003). An implementation study may also provide us with methods that will sustain ongoing knowledge use in clinical practice. Finally, communities of practice (CoPs) are defined as "groups of people who share a concern, set of problems or enthusiasm about a topic, and who deepen their knowledge and expertise about a topic by interacting on an ongoing basis" (Barwick et al., 2005; Li et al., 2009; Moodie et al., 2011b; Wenger, McDermott, & Snyder, 2002). One of the overarching

goals of this work is to develop the Network of Pediatric Audiologists of Canada into a CoP. Although the Network currently meets the criteria of a CoP from the domain, community and shared practice perspective, there is currently no structure (physical or internet-based) that enables them to interact directly with each other without the researchers as 'middle-(wo)men'. Future work will focus on obtaining funding to develop an e-based method for the CoP to interact with each other so that they might share ideas, information, ways of knowing and experiences.

4.10 References

American Academy of Audiology (AAA) Pediatric Amplification Guidelines (2003). Retrieved from: http://www.audiology.org/resources/documentlibrary/Documents/pedamp.pdf.

Anderson, K. L. (2000). Early Listening Function. Retrieved January 12, 2010 from: http://www.kandersonaudconsulting.com/uploads/ELF_Questionnaire.pdf

Anderson, K. L. & Smaldino, J. J. (2000). Children's home inventory of listening difficulties. Retrieved from: http://www.kandersonaudconsulting.com/uploads/child_questionnaire.pdf

Anderson, K.L. (1989). Screening identification for targeting educational risk (S.I.F.T.E.R.). Retrieved from: http://www.kandersonaudconsulting.com/uploads/SIFTER_Manual.pdf

Azjen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211. Retrieved from: http://people.umass.edu/psyc661/pdf/tpb.obhdp.pdf

Bagatto, M. P., Brown, C. L., Moodie, S. T., & Scollie, S. D. (2011). External validation of the LittlEARS® auditory questionnaire with English-speaking families of Canadian children with normal hearing. *International Journal of Pediatric Otorhyinolaryngology, 75,* 815-817. doi: 10.1016/j.ijporl.2011.03.014

Bagatto, M. P., Moodie, S. T., Malandrino, A. C., Richert, F. M., Clench, D. A., & Scollie, S. D. (2011). The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP). *Trends in Amplification, 15*(1), 57-76. doi: 10.1177/1084713811420304

Bagatto, M. P., Moodie, S. T., & Scollie, S. D. (2010). *The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP): Version 1.0.* Child Amplification Laboratory, University of Western Ontario: London, ON.

Bagatto, M. P., Moodie, S. T., Seewald, R. C., Bartlett, D. J., & Scollie, S. D. (2011). A critical review of audiological outcome measures for infants and children. *Trends in Amplification, 15*(1), 23-33. doi: 10.1177/1084713811412056

Bagatto, M. P., Scollie, S. D., Hyde, M. & Seewald, R. (2010). Protocol for the provision of amplification in the Ontario Infant hearing program. *International Journal of Audiology, 49*, S70-S79. doi: 10.3109/14992020903080751

Barwick, M. A., Boydell, K. M., Stasiulis, E., Ferguson, H. B., Blase, K., & Fixsen , D. (2005). Knowledge transfer and evidence-based practice in children's mental health. Toronto, ON: Children's Mental Health Ontario. Retrieved from: http://www.kidsmentalhealth.ca/documents/KT_exec_summary.pdf

Brouwers, M. C., Graham, I. D., Hanna, S. E., Cameron, D. A., & Browman, G. P. (2004). Clinicians' assessments of practice guidelines in oncology: the CAPGO survey. *International Journal of Technology Assessment in Health Care, 20*(4), 421-426. doi: 10.1017.S0266462304001308

Browman, G. P., & Brouwers, M. (2009). The role of guidelines in quality improvement for cancer surgery. *Journal of Surgical Oncology, 99*(8), 467-469. doi: 10.1002/jso.21171

Browman, G. P., Makarski, J., Robinson, P., & Brouwers, M. (2005). Practitioners as experts: The influence of practicing oncologists "in-the-field" on evidence-based guideline development. *Journal of Clinical Oncology, 23*(1), 113-119. doi: 10.1200/JCO/2005.06.179

Ceccato, N. E., Ferris, L. E., Manuel, D., & Grimshaw, J. M. (2007). Adopting health behavior change theory throughout the clinical practice guideline process. *The Journal of Continuing Education in the Health Professions, 27*(4), 201-207. doi: 10.1002/chp.138

Ching, T. Y., & Hill, M. (2005a). The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Diary. Chatswood, New South Wales, Australia: Australian Hearing. Retrieved from: http://www.outcomes.nal.gov.au/Assesments%20&%20Resources/PEACH%20Final%20April%2006%20_foldable_.pdf.

Ching, T. Y., & Hill, M. (2005b). The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Rating Scale. Chatswood, New South Wales, Australia: Australian Hearing. Retrieved from: http://www.outcomes.nal.gov.au/LOCHI%20assessments.html

College of Audiologists and Speech-Language Pathologists of Ontario (2000). Preferred practice guideline for the prescription of hearing aids to adults. Retrieved from: http://www.caslpo.com/Portals/0/ppg/preshearingaidsadults.pdf.

College of Audiologists and Speech-Language Pathologists of Ontario (2002). Preferred practice guideline for the prescription of hearing aids for children. Retrieved from: http://www.caslpo.com/Portals/0/ppg/preshearingaidschild.pdf.

Damschroder, L., Aron, D., Keith, R., Kirsh, S., Alexander, J., & Lowery, J., (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science, 4*:50. doi: 10.1186/1748-5908-4-50

Durlak, J. A., & DuPre, E. P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology, 41*, 327–350. doi: doi: 10.1007/s10464-008-9165-0

Eccles, M., Armstrong, D., Baker, R., Cleary, K., Davies, H., Davies, S., … Sibbald, B. (2009). An implementation research agenda. *Implementation Science*, *4,*18. doi: 10.1186/1748-5908-4-18

Eccles, M., Grimshaw, J., Johnston, M., Steen, N., Pitts, N. B., Thomas, R., … Walker, A. (2007). Applying psychological theories to evidence-based clinical practice: Identifying factors predictive of managing upper respiratory tract infections without antibiotics. *Implementation Science, 2*:26. doi: 10.1186/1748-5908-2-26

Eccles, M. P., Johnston, M., Hrisos, S., Francis, J., Grimshaw, J., Steen, N., & Kaner, E. F. (2007). Translating clinicians' beliefs into implementation interventions (TRACII): A protocol for an intervention modeling experiment to change clinicians' intentions to implement evidence-based practice. *Implementation Science*, *2:*27. doi: 10.1186/1748-5908-2-27

Erber, N. (1982). Glendonald auditory screening procedure. In *Auditory Training* (pp. 47-71). Washington, DC: Alexander Graham Bell Association.

Estabrooks, C. A., Floyd, J. A., Scott-Findlay, S., O'Leary, K. A., & Gushta, M. (2003a). Individual determinants of research utilization: A systematic review. *Journal of Advanced Nursing 43*(5), 506-520. doi: 10.1046/j.1365-2648.2003.02748.x

Estabrooks, C. A., Wallin, L., & Milner, M. (2003b). Measuring knowledge utilization in health care. *International Journal of Policy Evaluation & Management, 1*(1), 3-36. Retrieved from: http://www.uofaweb.ualberta.ca/kusp/pdfs/Estabrooks_Measurement_2003PublishedCopy.pdf

Evans, W. K., Graham, I. D., Cameron, D., Mackay, J. A., & Brouwers, M. (2006). Practitioner feedback on lung cancer practice guidelines in Ontario. *Journal of Thoracic Oncology, 1*(1), 10-18.

Fixsen, D., Naoom, S. F., Blase, K. A., Friedman, R. M., & Wallace, F. (2005). *Implementation Research: A synthesis of the literature*. Tampa, FL: University of South Florida, Louis de la Parte Florida Mental Health Institute, The National Implementation Research Network (FMHI Publication #231). Retrieved from: http://ctndisseminationlibrary.org/PDF/nirnmonograph.pdf

Francis, J. J., Tinmouth, A., Stanworth, S. J., & Eccles, M. P. (2009). Using theories of behaviour to understand transfusion prescribing in three clinical contexts in two countries: Development work for an implementation trial. *Implementation Science, 4,* 70. doi: 10.1186/1748-5908-4-70

Fung-Kee-Fung, M., Watters, J., Crossley, C., Goubanova, E., Abdulla, A., Stern, H., & Oliver, T. K. (2009). Regional collaborations as a tool for quality improvements in surgery: A systematic review of the literature. *Annals of Surgery, 249*(4), 565-572. doi: 10.1097/SLA.0b013e31819ec608

Gerrish, K., Ashworth, P., Lacey, A., Bailey, J., Cooke, J., Kendall, S., …McNeilly, E. (2007). Factors influencing the development of evidence-based practice: a research tool. *Journal of Advanced Nursing, 57*(3), 328-338. doi:10.1111/j.1365-2648.2006.04112.x

Gilliam, W. S., Ripple, C. H., Zigler, E. F., & Leiter, V. (2000). Evaluating child and family demonstration initiatives: Lessons from the Comprehensive Child Development Program. *Early Childhood Research Quarterly, 15*(1), 41-59. doi: 10.1016/S0885-2006(99)00041-1

Glasgow, R., & Emmons, K. (2007). How can we increase translation of research into practice? Types of evidence needed. *Annual Review of Public Health, 28*, 413-433. doi: 10.1146/annurev.publhealth.28.021406.144145

Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map? *The Journal of Continuing Education in the Health Professions, 26*, 13-24. doi: 10.1002/chp.47

Graham, I. D., & Tetroe, J. (2007). How to translate health research knowledge into effective health care action. *Healthcare Quarterly, 10*(3), 20-22. Retrieved from: http://www.hpme.utoronto.ca/Assets/hpme/events/hsr07/graham4.pdf

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly, 82*(4), 581-629. doi: 10.1111/j.0887-378X.2004.00325.x

Grol, R., & Grimshaw, J. (2003). From best evidence to best practice: effective implementation of change in patients' care. *Lancet, 362*, 1225-1230. doi: 10.1016/S0140-6736(03)14546-1

Grol, R. P. T. M., Bosch, M. C., Hulscher, M. E. J. L., Eccles, M., & Wensing, M. (2007). Planning and studying improvement in patient care: The use of theoretical perspectives. *Milbank Quarterly, 85*(1), 93-138. doi: 10.1111/j.1468-0009.2007.00478.x

Hakkennes, S., & Dodd, K. (2008). Guideline implementation in allied health professions: A systematic review of the literature. *Quality & Safety in Health Care, 17*(4), 296-300. doi: 10.1136/qshc.2007.023804

Harrison, M. B., Graham, I. D, & Fervers B. (2009). Adapting knowledge to a local context. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 73-82). Hoboken NJ: Blackwell Publishing Ltd.

Harrison, M. B., Légaré, F., Graham, I. D., & Fervers, B. (2010). Adapting clinical practice guidelines to local contexts and assessing barriers to their use. *CMAJ, 182*(2), E78-E84. doi: 10.1503/cmaj.081232

Iler-Kirk, K., Pisoni, D. B., Osberger, M. J. (1995). Lexical effects on spoken word recognition by pediatric cochlear implant users. *Ear & Hearing. 16*:470-481. doi: 35400005056305.0040

Iles, R., & Davidson, M. (2006). Evidence based practice: A survey of physiotherapists' current practice. *Physiotherapy Research International, 11*(2), 93-103. doi: 10.1002/pri.328

King, A. (2010). The national protocol for paediatric amplification in Australia. *International Journal of Audiology, 49*, S64-S69. doi: 10.3109/14992020903329422

Légaré, F. (2009). Assessing barriers and facilitators to knowledge use. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 83-93). Hoboken: Blackwell Publishing Ltd.

Li, L. C., Grmishaw, J. M., Nielsen, C., Judd, M., Coyte, P. C., & Graham, I. D. (2009). Evolution of Wenger's concept of community of practice, *Implementation Science*, *4*:11. doi: 10.1186/1748-5908-4-11

Lovelock (unpublished). Client Oriented Scale of Improvement – Child Version (COSI-C). *Australian Hearing,* Retrieved April 15, 2009 from http://www.nal.gov.au/pdf/COSI-C-Questionnaire.pdf.

Maher, C. G., Sherrington, C., Elkins, M., Herbert, R. D., & Moseley, A. M. (2004). Challenges for evidence-based physical therapy: accessing and interpreting high-quality evidence on therapy. *Physical Therapy, 84*, 644-654. Retrieved from: http://www.physicaltherapyjournal.com/content/84/7/644.full

McCleary, L., & Brown, G. T. (2003). Barriers to paediatric nurses' research utilization. *Journal of Advanced Nursing, 42*(4), 364-372. doi: 10.1046/j.1365-2648.2003.02628.x

McCluskley, A. (2003). Occupational therapists report a low level of knowledge, skill and involvement in evidence-based practice. *Australian Occupational Therapy Journal, 50*(1), 3-12. doi: 10.1046/j.1440-1630.2003.00303.x

McCormack, B., Kitson, A., Harvey, G., Rycroft-Malone, J., Titchen, A., & Seers, K. (2002). Getting evidence into practice: the meaning of context. *Journal of Advanced Nursing, 2002*(38), 94-104. doi: 10.1046/j.1365-2648.2002.02150.x

Michie, S., Fixsen, D., Grimshaw, J., & Eccles, M. (2009). Specifying and reporting complex behaviour change interventions: The need for a scientific method. *Implementation Science, 4*:40. doi: 10.1186/1748-5908-4-40

Modernising Children's Hearing Aid Services (2007). Guidance on the use of real ear measurement to verify the fitting of digital signal processing hearing aids. Retrieved from: http://www.thebsa.org.uk/docs/RecPro/REM.pdf.

Moodie, S. T. (2009). Clinician fit-to-DSL targets: Preliminary data from a network study. *Audiology Online.* Retrieved from: http://www.audiologyonline.com/ceus/livecoursedetails.asp?class_id=14417

Moodie, S. T. (2010, October 6). *Engaging audiologists in research: The Network of Pediatric Audiologists of Canada.* Paper presented at the Canadian Academy of Audiology (CAA) Conference, Montreal, Quebec, Canada.

Moodie, S. T., Bagatto, M. P., Miller, L. T., Kothari, A., Seewald, R. C., & Scollie, S. D. (2011). An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). *Trends in Amplification, 15*(1), 34-56. doi: 10.1177/1084713811417634

Moodie, S. T., Kothari, A., Bagatto, M. P., Seewald, R. C., Miller, L., & Scollie, S. D. (2011). Knowledge translation in audiology: Promoting the clinical application of best evidence. *Trends in Amplification, 15*(1), 5-22. doi: 10.1177/1084713811420740

Mueller, H. G. (2003). In the words of Shakespeare: Fitting test protocols are "more honored in the breach than in the observance". *The Hearing Journal, 56*(10), 19-26. doi: 10.1097/01.HJ.0000292915.14697.f3

Mullins, R. (2005). Survey tests members understanding of evidence-based practice. *ASHA Leader*, *4,* 11.

Quiros, D., Lin, S., & Larson, E.L. (2007). Attitudes toward practice guidelines among intensive care unit personnel: A cross-sectional anonymous survey. *Heart & Lung*, 36(4), 287-297. doi: 10.1016/j.hrtlng.2006.08.005

Ramsay, C., Thomas, R., Croal, B., Grimshaw, J., & Eccles, M. (2010). Using the theory of planned behaviour as a process evaluation tool in randomised trials of knowledge translation strategies: A case study from UK primary care. *Implementation Science, 5*(1), 71. doi: 10.1186/1748-5908-5-71

Rogers, E. M. (2003). *Diffusion of Innovations* (Fifth ed.). New York, NY: Simon & Shuster, Inc.

Rycroft-Malone, J. (2004). The PARIHS framework: A framework for guiding the implementation of evidence-based practice. *Journal of Nursing Care Quality, 19*(4), 297-304. Retrieved from: http://basal-stimulation.eu/Pflege/pflege-ol/PARIHS.pdf

Rycroft-Malone, J., Harvey, G., Seers, K., Kitson, A., McCormack, B., & Titchen, A. (2004). An exploration of the factors that influence the implementation of evidence into practice. *Journal of Clinical Nursing, 19*, 913-924. doi: 10.1111/j.1365-2702.2004.01007.x

Rycroft-Malone, J., Kitson, A., Harvey, G., et al. (2002). Ingredients for change: Revisiting a conceptual framework. *Quality and Safety in Health Care, 11*, 174-180. doi: 10.1136/qhc.11.2.174

Salisbury, M. (2008a). A framework for collaborative knowledge creation. *Knowledge Management Research and Practice, 6*, 214-224. doi: 10.1057/kmrp.2008.10

Salisbury, M. (2008b). From instructional systems design to managing the life cycle of knowledge in organizations. *Performance Improvement Quarterly, 20*(3-4), 131-145. doi: 10.1002/piq.20007

Shiffman, R.N. (2009). Clinical practice guidelines: Supporting decisions, optimizing care. In Lehmann, C.U., Kim, G.R., Johnson, K.B. (Eds.), *Pediatric Informatics: Computer Applications in Child Health* (pp.149-159). Retrieved from http://www.springerlink.com/content/978-0-387-76445-0.

Shiffman, R.N., Dixon, J., Brandt, C., O'Connell, R., Essaihi, A., Michel, G., & Hsiao, A. (2005). *GLIA: GuideLine Implementability Appraisal v1.0*. New Haven, CT: Yale Center for Medical Informatics. Retrieved from: http://gem.med.yale.edu/glia/doc/GLIA_v1.pdf

Stahl, G. (2000). A Model of Collaborative Knowledge-Building. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Fourth International Conference of the Learning Sciences* (pp. 70-77). Mahwah, NJ: Erlbaum. Retrieved from http://www.umich.edu/~icls/proceedings/pdf/Stahl.pdf.

Stern, H., Fung-Kee-Fung, M., Urbach, D., Smith, A., Brouwers, M., & Langer, B. (2007). *Sustainable improvement in quality indicators in Ontario's surgical oncology program (SOP).* Paper presented at the 2007 ASCO Annual Meeting Proceedings Part I. Vol 25, No. 18S (June 20 Supplement), 2007: 6638. Retrieved from: http://www.asco.org/ascov2/Meetings/Abstracts?&vmview=abst_detail_view&confID=47&abstractID=31088

Straus, S. E. (2009). The Action Cycle. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 59). Hoboken NJ: Blackwell Publishing Ltd.

Straus, S. E., Tetroe, J., & Graham, I. D. (2009). Knowledge to action: what it is and what it isn't. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 3-9). Hoboken: Blackwell Publishing Ltd.

Straus, S., Tetroe, J., & Graham, I. D. (2011). Knowledge translation is the use of knowledge in health care decision making *Journal of Clinical Epidemiology, 64*(1), 6-10. doi: 10.1016/j.jclinepi.2009.08.016

Tsiakpini, L., Weichbold, V., Kuehn-Inacker, H., Coninx, F., D'Haese, P., & Almadin, S. (2004). LittlEARS Auditory Questionnaire. Innsbruck, Austria: MED-EL.

Wensing, M., Bosch, M., & Grol, R. (2009). Selecting, tailoring, and implementing knowledge translation interventions. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 94-112). Hoboken: Blackwell Publishing Ltd.

Zimmerman-Phillips, S., Osberger, M. J., & Robbins, A. M. (2000). Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS). *Symlar:* Advanced Bionics Corporation. Retrieved from http://www.advancedbionics.com/UserFiles/File/IT-MAS_20brochure_20_2.pdf

Zipoli, R. P., Jr., & Kennedy, M. (2005). Evidence-Based Practice Among Speech-Language Pathologists: Attitudes, Utilization, and Barriers. *American Journal of Speech-Language Pathology, 14*(3), 208-220. doi: 10.1044/1058-0360(2005/021)

Chapter 5

5 Evaluation of the University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0).

Clinical practice guidelines (CPGs) are "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances" (Field & Lohr, 1990, p.38). The profession of audiology values clinical practice guidelines and considers them important instruments to translate evidence into practice. A well-planned and written audiology guideline promotes quality of services by reducing practice variation, improving diagnostic accuracy, promoting effective habilitation/rehabilitation treatment, and discouraging ineffective, or potentially harmful treatment interventions (Moodie, Kothari et al., 2011). It is important to note that guidelines are never intended to replace professional clinical judgment and training. The development of clinical practice guidelines is a difficult, highly-complex process which requires, on average, about 2 to 3 years per guideline and often encompasses recommendations based on little or low-quality evidence because of gaps in the evidence base (Damschroder et al., 2009; Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003; Fixsen, Naoom, Blase, Friedman, & Wallace, 2005; Glasgow & Emmons, 2007; Moodie, Kothari et al., 2011; Rosenfeld & Shiffman, 2009).

Despite significant efforts to develop evidence-based, high-quality guidelines, studies have shown that the extent to which practitioners implement the guideline as written vary significantly. For example, Grol (2001) selected key adherence indicators for guideline recommendations and studied the behavior of 200 physicians in the Netherlands. He reported average overall adherence scores to clinical guidelines to be 67%. The adherence scores ranged from 34.4% for otitis externa guideline indicators, to 100% for guideline adherence to micturation problems in older men. A more recent study (Rutten et al., 2010) found a similar rate (67%) for overall adherence to clinical guidelines for the treatment of low back pain by physiotherapists. Adherence rates ranged from 2.2% to 99.3% for the diagnostic process; and 47.5% to 88.1% for the therapeutic part of the

process (Rutten et al., 2010). Of interest to audiologists, is a study that showed that although 90.5% of primary care physicians had read the 2004 acute otitis media (AOM) clinical practice guideline many did not follow its diagnostic and antibiotic recommendations (Vernacchio, Vezina, & Mitchell, 2006). For audiologists in clinical practice, the use of real-ear probe-microphone measures for the fitting and verification of hearing aids has been an important component of best practice guidelines for adults and children for many years (Bagatto, Scollie, Hyde, & Seewald, 2010; College of Audiologists and Speech-Language Pathologists of Ontario [CASLPO], 2000, 2002; Joint Committee on Infant Hearing [JCIH], 2000; JCIH, 2007; King, 2010; Valente et al., 2006). In clinical practice, however, studies have shown that 59% to 75% of adult hearing aid fittings are *not* verified with real-ear measures of hearing aid performance (Lindley, 2006; Mueller, 2003; Mueller & Picou, 2010; Strom, 2006; 2009), despite the fact that these measures are related to customer satisfaction (Kochkin et al., 2010).

Adopting an integrated knowledge translation (*i*KT) approach to conducting research studies could assist in the development of high-quality evidence for use in guideline development. Integrated knowledge translation (KT) represents a new model of knowledge production (Gibbons, Limoges, Nowotny, Schwartzman, Scott, & Trow, 1994), and involves active collaboration between researchers and research users in all parts of the research process including: designing the research questions; shared decision-making regarding methodology; data collection and tools development; interpretation of the findings; and dissemination and implementation of the research results. An *i*KT framework that could assist in the development of guidelines that might be better-adhered to in practice is the knowledge-to-action (KTA) process developed by Graham and colleagues (Graham et al., 2006; Graham & Tetroe, 2007; Moodie, Kothari et al., 2011; Straus, Tetroe & Graham, 2009). The KTA process would involve active collaboration between researchers and knowledge users throughout the guideline development process. One significant advantage to this approach is that it takes into consideration values, preferences and determinants to implementation of the guideline in clinical practice. (Graham et al., 2006; Graham & Tetroe, 2007; Harrison, Légaré, Graham & Fervers, 2010; Straus et al., 2009). The KTA process is illustrated in Figure 5-1.

There are **<u>two</u> cycles** occurring in the KTA process: 1) **a knowledge creation funnel;** and 2) an **application of knowledge cycle**. The boundaries between the two cycles can be 'permeable and fluid' if desired, or one cycle could be independent from the other (Graham et al., 2006; Graham & Tetroe, 2007; Moodie, Kothari et al., 2011; Straus et al., 2009).

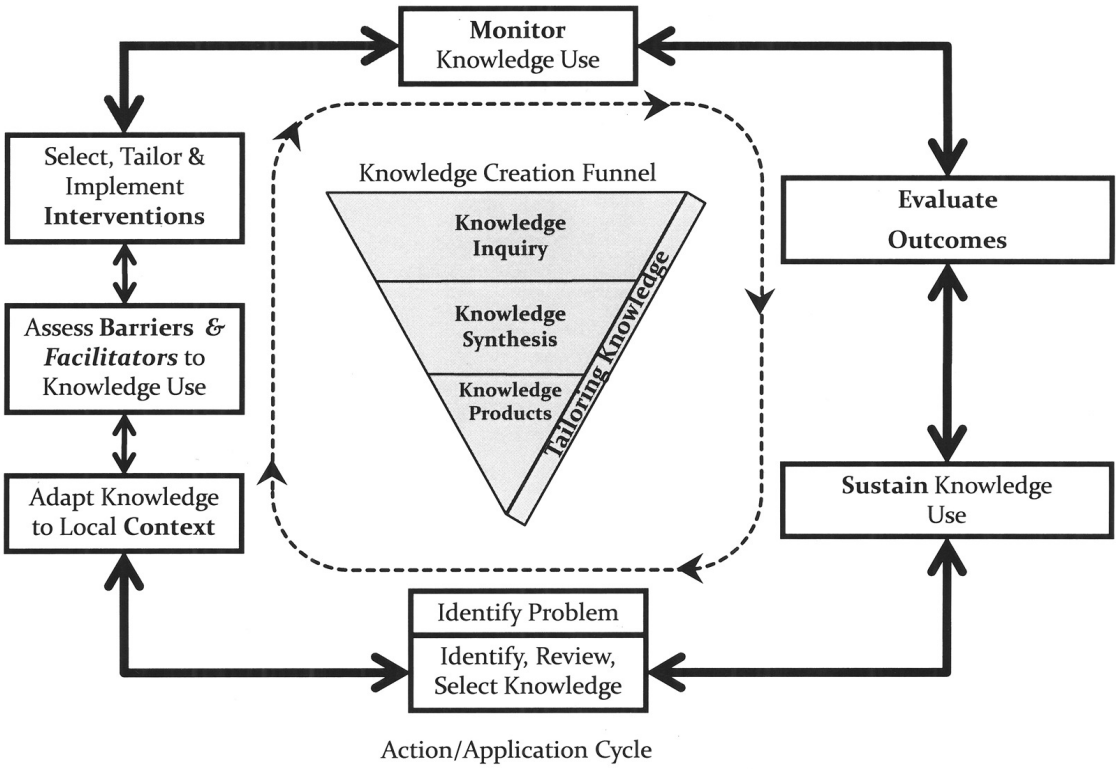


Figure 5-1: The knowledge-to-action process (Graham et al., 2006).

Adapted from "Lost in knowledge translation: Time for a map?" by I. Graham, J. Logan, M. B. Harrison, S. Straus, J. Tetroe, W. Caswell, & N. Robinson, 2006, *The Journal of Continuing Education in the Health Professions, 26,* p. 19. Copyright 2006 by John Wiley and Sons. Reprinted with permission.

The **knowledge creation funnel** takes the multitude of available evidence, or works with end-users of research to create the evidence (at the knowledge inquiry stage) and synthesizes it (synthesis stage), ultimately filtering using *a priori* criteria until the best evidence is compiled (see Figure 5-1). At the final stage, knowledge, in the form of knowledge tools, products, or guidelines, is presented in clear, concise and appropriate formats to influence clinical practice, stakeholders, and end-users in such a way to promote uptake of the knowledge. An important component to the knowledge creation

cycle is that at each stage the knowledge should be tailored and/or customized, ideally with input from the end users, to facilitate implementation.

The **action (application) cycle** of the process facilitates the science of implementation (see Figure 5-1). It represents the various activities that may be needed for the integration of the knowledge in clinical practice.

The action cycle includes:

- identification of a problem that needs addressing/identification, review and selection of knowledge/research relevant to addressing the problem
- adaptation of the evidence / knowledge / research to the local context;
- assessment of the barriers to using the knowledge;
- selecting, tailoring and implementing interventions to promote the use of the knowledge within clinical practice settings;
- monitoring of knowledge use;
- evaluation of clinical uptake outcomes of using the knowledge;
- methods to sustain ongoing knowledge use.

The application of the knowledge cycle in this model takes into account many of the criticisms related to implementing evidence into clinical practice currently reported in the literature. (Cohen, Stavri, & Hersh, 2004; Graham et al., 2006; Moodie et al., 2011; Mullen & Steiner, 2004; Murray, Holmes, & Rail, 2008; Straus & McAlister, 2000; Upshur, VanDenKerkof, & Goel, 2001). By considering the potential barriers and facilitators to knowledge use and multi-faceted implementation strategies during the knowledge creation process, it is anticipated that the KTA process will improve uptake of guidelines into clinical practice.

This paper describes the development and final evaluation of an *i*KT project to produce a guideline for outcome measures to evaluate the auditory development and performance of children with permanent childhood hearing impairment (PCHI) who wear hearing aids and are aged birth to six years (Bagatto, Moodie, Seewald, Bartlett, & Scollie, 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011). Throughout this project we

defined knowledge creation as the social collaboration and negotiation of different perspectives, including personal experience, empirical evidence and logical deduction that resulted in acceptance of a common result (Brown & Duguid, 2001; Conklin, Kothari, Stolee, Chambers, Forbes, & Le Clair, 2011; Moodie, Kothari et al., 2011; Nutley, Walter & Davies, 2003; Stahl, 2000).

5.1 Background

Pediatric audiologists provide infants and young children with hearing loss access to speech and other important environmental sounds through the use of well-fitted hearing aids. Evidence-based hearing aid fitting protocols currently exist, and they state that the hearing aid fitting process is comprised of appropriate assessment, selection and fitting of amplification, verification that the specified acoustical prescriptive targets have been achieved, and outcome evaluation of device effectiveness in daily life (American Academy of Audiology [AAA], 2003; Bagatto et al., 2010; College of Audiologists and Speech Language Pathologists of Ontario [CASLPO], 2000, 2002; King, 2010; Modernising Children's Hearing Aid Services, 2007). The outcome evaluation stage of the hearing aid fitting process within these guidelines lacks evidential, well-validated methods for appraising the auditory development and performance of young children fitted with hearing aids (Bagatto, Moodie, Seewald et al., 2011). This gap in evidence-based outcome measurement tools was reported by Canadian pediatric audiologists as a barrier to providing high-quality and effective services to children and their families (Chapter 3; Moodie, Kothari et al., 2011). Therefore, in 2008, a Network of Pediatric Audiologists of Canada was formed to collaboratively work to reduce the knowledge gap. The first objective for the group: participation in an *i*KT project to develop an outcome measures guideline to evaluate the auditory development and performance of children with permanent childhood hearing impairment (PCHI) who wear hearing aids and are aged birth to six years (Bagatto, Moodie, Seewald et al., 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011).

5.2 Knowledge creation and The UWO PedAMP v1.0

As depicted in Figure 5-1, knowledge creation begins with the inquiry and synthesis stages. The Network audiologists provided the research team with information regarding outcome evaluation tools that they had successfully or unsuccessfully used in clinical practice. A critical review, which included a synthesis and systematic grading of audiological outcome measures for infants and children, was conducted (Bagatto, Moodie, Seewald et al., 2011). Although there were many subjective tools available for inclusion in a guideline for use with this population, few had the relevant psychometric and/or feasibility characteristics necessary to promote clinical uptake (Bagatto, Moodie, Seewald et al., 2011). Results of the critical review provided two clinically feasible outcome evaluation tools to be considered for inclusion in a guideline: The LittlEARS® Auditory Questionnaire (Tsiakpini et al., 2004) and the Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Rating Scale (Ching & Hill, 2005b). The PEACH Diary (Ching & Hill, 2005a) received a higher evidential grade than the PEACH Rating Scale however there was concern that the interview-style format associated with the diary may introduce clinical feasibility and utility issues (Bagatto, Moodie, Seewald et al., 2011). Guided by the KTA framework, our task was to tailor the synthesized evidence in the form of a knowledge product that would be appropriate and relevant for clinical use by audiologists. The Network team and the research team worked collaboratively to accomplish this task. To facilitate the application of the knowledge in practice, a questionnaire was developed to identify the necessary adaptations to the guideline, and to identify, where possible, barriers to its clinical use. Using this questionnaire, the three potential outcome evaluation tools (LittlEARS, PEACH rating scale and PEACH diary) and associated clinical-use materials (background information, clinical instruction sheets, and scoring sheets) were each evaluated by the Network of Pediatric Audiologists of Canada (Chapter 4; Moodie, Bagatto et al., 2011) in terms of their perceived quality, feasibility, clinical value, applicability, clarity, and interpretability. Perceptions of barriers and facilitators to the use of outcome measurement tools in general, and for these three tools specifically, were solicited. Suggested recommendations for revisions, modifications and/or additions were also requested. Results of this 'tailoring' of the

guideline (knowledge product) are presented in Chapter 4 of this dissertation, and published as Moodie, Bagatto et al., 2011. One noteworthy result was that regardless of the context in which they worked, the Network audiologists found the PEACH Rating Scale to be a more clinically feasible outcome evaluation tool to include in the guideline compared to the PEACH diary (Moodie, Bagatto et al., 2011). Audiologists indicated that the PEACH rating scale was less difficult to score and interpret, less time consuming for parents and audiologists, would have more support and acceptance for use in their workplace setting, would require less development of new skills and knowledge to be able to use, and was more practical to implement than the PEACH diary. More audiologists indicated that they were more likely to use the PEACH rating scale in daily practice if it became part of the guideline. So, despite the fact that the PEACH diary had a stronger evidential base, knowledge users indicated that the PEACH rating scale was more likely to be used in practice.

In an effort to reduce barriers to implementation, the research team reviewed all of the data provided by the Network audiologists and made revisions to the materials where possible, including for example: revision to scoring sheets, newly developed training materials (including training DVD/CD), development of translated materials into requested languages, and administration guideline flowcharts. The final version of the guideline has been released as The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) version 1.0 (Bagatto, Moodie, Malandrino et al., 2011; Bagatto, Moodie & Scollie, 2010).

This paper presents the results of the final evaluation of the UWO PedAMP v1.0 by the Network of Pediatric Audiologists of Canada. The UWO PedAMP is comprised of the following tools:

1. Aided Speech Intelligibility Index (SII) Normative Values Worksheet;
2. Hearing Aid Fitting Summary;
3. LittlEARS Auditory Questionnaire (Tsiakpini et al., 2004; Copyright MED-EL, 2004);

4. Parents' Evaluation of Aural/Oral Performance of Children (PEACH; Ching & Hill, 2005a, b; Copyright Australian Hearing, 2005). The version of the PEACH included is the PEACH rating scale.

Briefly, the Aided Speech Intelligibility Index (SII) Normative Values Worksheet and the Hearing Aid Fitting Summary are used to characterize and document important components of the hearing aid fitting process (e.g., an appropriately fitted hearing aid; and real-ear probe-microphone measures of electroacoustic performance). These should occur prior to measuring functional outcomes with the LittlEARS or PEACH. Additional information on these measures and their clinical application can be found in Bagatto, Moodie, Malandrino et al., 2011 and Bagatto, Moodie, Seewald et al., 2011).

5.3 Methods

5.3.1 Participants

Participants were purposefully selected pediatric audiologists who had been invited to be members of The Network of Pediatric Audiologists of Canada. This group initially consisted of 25 pediatric audiologists and/or pediatric audiology department managers from six provinces in Canada.

Prior to the start of the project, after our initial focus group meetings, three audiologists withdrew from the Network due to job change (n=2) and career change (n=1). This left 22 pediatric audiologists to evaluate the initial individual components of the UWO PedAMP and complete a final evaluation of the released document.

5.3.2 Ethics

This study was reviewed and approved by The University of Western Ontario's Research Ethics Board for Health Sciences Research.

5.3.3 Survey Instrument

A questionnaire was developed for use in this project as there was no previously developed, validated questionnaire that covered all the important constructs that we wished to measure. Prior to sending the questionnaires to the pediatric audiologists it was reviewed by the research/authorship team which included experts in the areas of audiology, research design and methodology and knowledge translation to ensure clarity of instructions and feasibility of the online approach to data collection.

The Network audiologists were not requested or required to have implemented the UWO PedAMP in clinical practice prior to answering the questionnaire. Some of the audiologists were using it in practice while others had not implemented it prior to answering the questionnaire.

The questionnaire was comprised of a letter of information and 96 items divided into 11 sections for the pediatric audiologists' consideration. The items were developed based on the KTA framework and characteristics of the guideline, practitioner, and context in which pediatric audiologists work that influence the use of knowledge and evidence in clinical practice. Some item wording was developed from other similar work (Brouwers, Graham, Hanna, Cameron, & Browman, 2004; Ceccato, Ferris, Manuel, & Grimshaw, 2007; Eccles, Grimshaw et al., 2007; Evans, Graham, Cameron, Mackay, & Brouwers, 2006; Francis, Tinmouth, Stanworth, & Eccles, 2009; Gerrish et al., 2007; Michie, Fixsen, Grimshaw, & Eccles, 2009; Quiros, Lin, & Larson, 2007; Ramsay, Thomas, Coral, Grimshaw, & Eccles, 2010; Shiffman et al., 2005). Table 5-1 provides an overview of the sections included in the questionnaire and number of items per section. At the end of each section respondents were invited to provide additional written/typed information or comments where they felt appropriate and helpful. An email invitation to participate in the final evaluation of the UWO PedAMP was sent to the members of the Network of Pediatric Audiologists of Canada with a link to the e-survey. The online survey tool SurveyMonkey™ (www.surveymonkey.com) was used for this study. The decision to use an online survey system over a focus group was to enable pediatric audiologists from across the country to participate. Gathering the participants in one

place for a focus group meeting was time and cost prohibitive. The items were presented in SurveyMonkey with clear instructions asking that items related to level of knowledge, familiarity and/or comfort be answered using a three-point rating scale, and items asking about agreement or disagreement be answered using a five-point scale.

Table 5-1: Questionnaire sections and number of items included in each section for the audiologist's consideration.

Section Title	Number of Items
Quality	7
Feasibility/Executability	13
Utility/Comparative Value/Relative Advantage	5
Acceptability/Applicability	21
Interpretability	4
Clarity	1
Clinical Use Recommendations	3
Barriers	20
Facilitators	13
Revisions/Modifications/Additions	2
Partnership Experience	7

For this study, data analyses were descriptive in nature. Detailed statistical analyses were not performed on the survey data as the study aimed to provide an overall picture of pediatric audiologists' perceptions of the UWO PedAMP v1.0. The respondents were not required to provide responses to all questions; therefore the sample size may vary slightly from question to question. The content of the open-ended responses were examined to see how they enhanced our understanding of the objective measures.

5.4 Results

The survey was completed by 14 of the 22 audiologists associated with the Network of Pediatric Audiologists of Canada, providing a 63% response rate.

5.4.1 Quality Ratings for the UWO PedAMP v1.0

The pediatric audiologist respondents agreed (~93%) that the UWO PedAMP was a high-quality hearing aid outcome evaluation tool that provided them with an opportunity to improve the quality of audiological care received by infants/children and their families. Table 5-2 presents the results of the level of agreement with items associated with quality of the UWO PedAMP. There was unanimous agreement (100%) that clinical implementation of the UWO PedAMP would result in a systematic evaluation of auditory-related outcomes. Most respondents indicated that the results of the UWO PedAMP would assist the audiologist (93%) and the parent (85%) in decision-making.

5.4.1.1 Select comments by Network audiologists regarding quality of the UWO PedAMP

- *I have been using all of the aspects of the PedAmp and find it an excellent asset to my practice. I can see for myself how the child is progressing and show this to the parents as well. I have done some of these measures 4 or 5 times on individual children and the progression of their performance auditorily or developmentally is a valuable tool to have and illustrate to the parents. … I think it is great to finally have some objective and subjective measures to document what I am doing. I also find it helpful for those families that will not put amplification on their children and now I have evidence (LittlEARs, PEACH) of why they need to aid. It's not just my opinion anymore but I can document that their child is not within normal limits... sometimes they listen but sometimes they still do not follow my recommendations even with the evidence.*

- *Decisions that would have been made based on audiological results, parents' reports of auditory and Speech Language behavior, input from SLPs* (Speech-Language Pathologists) *or AV* (Auditory Verbal) *therapist would be no different than what would be made with the addition of the PedAMP info. The PedAMP info does allow the ministry to perhaps collect some relatively simple information for quality control purposes.*

Table 5-2: Level of agreement with statements related to quality of the UWO PedAMP.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The UWO PedAMP is a high-quality hearing aid outcome evaluation tool	93	7	0
The UWO PedAMP offers an opportunity for appreciable improvement in the quality of audiological care provided to infants/children and their families	92	0	8
The rationale for use of the UWO PedAMP is stated clearly in the manual	100	0	0
The criteria/reasons for selecting the measures included in the UWO PedAMP are clearly described in the manual	93	7	0
Implementation of the UWO PedAMP in clinical practice will result in a systematic evaluation of several auditory-related outcomes of infants and children who wear hearing aids	100	0	0
The results of the UWO PedAMP will assist the audiologist in decision-making	93	0	7
The results of the UWO PedAMP will assist the parent in decision-making	85	15	0

5.4.2 Feasibility/Executability

Audiologist respondents were queried about the potential for successful implementation of the UWO PedAMP in clinical settings. The results are presented in Table 5-3. Most respondents agreed to strongly agreed ($\geq$ 93%) that the manual documentation was well-organized, easy to understand, with clear sequencing of test measure administration included. Eighty-six percent stated that patient results could be reported with ease.

Table 5-3: Level of agreement with statements related to the practical extent to which the UWO PedAMP can be implemented successfully in clinical settings.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The format and style of the UWO PedAMP is easy to understand and follow	100	0	0
The sequence in which components of the UWO PedAMP should be administered is clear	93	7	0
In administration of the UWO PedAMP, the ANDs or Ors are clear. That is, when you are supposed to administer something in combination (AND) or when you are supposed to administer something instead (OR)	100	0	0
Patient results for the UWO PedAMP can be reported with ease	86	7	7
The task related to completion of the UWO PedAMP components is not too difficult for the parent (respondent) to perform	86	14	0
The task related to completion of the UWO PedAMP components is not too difficult for the audiologist to perform	93	7	0
The task related to the completion of the UWO PedAMP components is not too time-consuming for the **parent (respondent)** to perform	86	7	7
The task related to completion of the UWO PedAMP components is not too time-consuming for the **audiologist** to perform	71	29	0

Table 5-3 continued: Level of agreement with statements related to the practical extent to which the UWO PedAMP can be implemented successfully in clinical settings.

Item	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The length of time it takes to administer the UWO PedAMP is appropriate for incorporation into routine clinical practice	79	21	0
The length of time it takes to score and interpret the results of the UWO PedAMP is appropriate for incorporation into routine clinical practice	79	14	0
The length of time it takes include the results of the UWO PedAMP into written clinical reports is appropriate for incorporation into routine clinical practice	71	29	0
The length of time it takes to counsel parents about the results of the UWO PedAMP makes it appropriate for incorporation into routine clinical practice	93	7	0

Clinical time to implement measures has been cited as a barrier by the Network audiologists to the uptake of outcome evaluation tools in practice (Bagatto, Moodie, Seewald et al., 2011; Moodie, Bagatto et al., 2011). Results of this evaluation of the UWO PedAMP indicated that the majority of audiologists (≥ 79%) believed that the length of time it would take to administer, score, interpret results of the UWO PedAMP and counsel parents was appropriate for incorporation into routine clinical practice. Most of the remaining audiologists (~ 21%) indicated that they neither agreed nor disagreed with the item statements. Eighty-six percent of respondents agreed to strongly agreed that completion of the UWO PedAMP components was not too time-consuming for the parent/respondent to perform, however, only 71% agreed to strongly agreed that

completion of the individual components associated with the UWO PedAMP was not too time-consuming for the audiologist to perform. Seven percent were unsure (chose neither agree nor disagree) and the remaining seven percent (1 respondent) reported that he/she felt that the task was too time-consuming for the parent/respondent to perform.

Audiologist respondents largely agreed (≥ 86%) that it was not too difficult to score each of the individual test measures included in the UWO PedAMP. Results of their evaluation are shown in Table 5-4.

Table 5-4: Level of agreement with statements related to difficulty in scoring the components of the UWO PedAMP.

Item	Level of Agreement (n=14)		
Scoring is difficult for the:	**Agree to Agree Strongly (%)**	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Hearing Aid Fitting Details & Summary	0	7	93
Aided Speech Intelligibility Index (SII)	0	7	93
LittlEARS Auditory Questionnaire	0	0	100
Parents' Evaluation of Aural/Oral Performance in Children (PEACH)	0	14	86

5.4.2.1 Select comments by Network audiologists regarding clinical feasibility of the UWO PedAMP

- *Administration summary tables allow for clear understanding of sequencing and time frames for administration of the evaluation tools. The task for parents is not too time consuming but some families struggle to interpret questions and relate their experiences with the child to the questions on the forms. Interview style administration is required with many families for whom the outcome measure is new and unfamiliar, where English is a second language or those that are less knowledgeable or informed about child development and auditory behaviours. For audiologists, the administration of the UWO PedAMP can be time consuming when*

interview style administration is required with significant discussion to facilitate understanding. On the other hand, many families complete the outcome measures independently while assessment of amplification is being completed by the audiologist. Scoring of the outcome measures is straight forward and the normative tables allow for quick interpretation of the child's results. Reporting in clinical reports requires a minimal amount of additional time and is appropriate for routine practice. Sample descriptions for reporting in the PedAMP were useful during the initial implementation phase.

- *Parents do have difficulty remaining consistent in their completion of the forms. For some (not all parents) scores may vary in a negative fashion over time, with no decline in AV skills. Fathers/mothers very often differ in their scoring. Parents are beginning to say "did we not just do this" and to complain somewhat about the frequency of repetition of questionnaires. Counselling regarding benefit from amplification and associated speech-language skills would have taken place independent of the results on the PedAMP*

5.4.3 Utility/Comparative Value/Relative Advantage

The five items in this section of the questionnaire queried respondents' perspectives on the value that the UWO PedAMP had relative to other measures they used for hearing aid outcome evaluation with young children. Results are displayed in Table 5-5. Eighty percent of respondents indicated that the UWO PedAMP reflects a more clinically effective approach for evaluating auditory-related outcomes for children aged birth to 6 years than what they were currently doing in practice. An additional 14% indicated that they neither agree nor disagree that it provides a more clinically effective approach to evaluation. One respondent indicated that from his/her perspective the UWO PedAMP did not reflect a more clinically effective approach to auditory-related outcome evaluation than what he/she was currently implementing in practice. Habits and practice-as-usual mindset will not limit uptake of the UWO PedAMP by the majority (71%) of responding audiologists. The administration guideline graph (shown in Figure 5-2) that is included in the UWO PedAMP documentation provides a quick, visual reminder of which of the tools to use for an individual child at a given appointment, however, based

on the results of the current evaluation, it does not appear to guarantee that it is easy to remember to administer the UWO PedAMP relative to what audiologists were currently doing in practice.

Table 5-5: Level of agreement with statements related to the value of the UWO PedAMP relative to other clinical measures used for hearing aid outcome evaluation for children birth to 6 years of age.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The UWO PedAMP reflects a more clinically effective approach for evaluating auditory-related outcomes for children birth to 6 years of age who wear hearing aids than what I am currently doing in my practice	79	14	7
When applied, the UWO PedAMP will result in better use of resources than current usual practice	57	36	7
The format of the UWO PedAMP is easier to remember compared with other tools that I am familiar with that could be used to evaluate auditory-related outcomes of infants and children birth to 6 years of age who wear hearing aids	43	57	0
The UWO PedAMP administration guideline graph (that shows what outcome measurement tool(s) should be administered at various unaided and aided appointment types) helps to remind clinicians which measures should be made and when they should be made	85	8	8
Habits and doing what I have always done will limit uptake of the UWO PedAMP in my daily practice	0	29	71

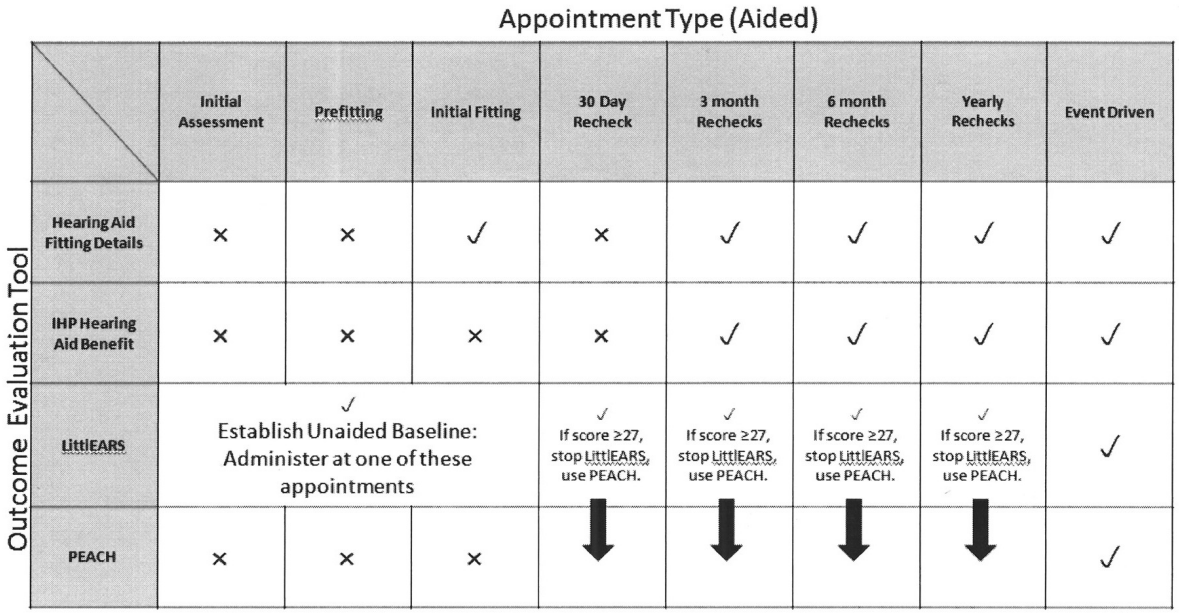


Figure 5-2: The Outcome Evaluation Tool by Appointment reminder grid.

From *"The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) version 1.0* by M. Bagatto, S. Moodie & S. Scollie. Copyright 2010 by Child Amplification Laboratory, National Centre for Audiology, Univ. of Western Ontario. Reprinted with permission.

5.4.3.1 Select comments by Network audiologists regarding utility/comparative value of the UWO PedAMP

- *I have found the PedAMP easy to incorporate into my daily practice and generally experience success in completing the tools as required. PedAMP is clinically effective as it ensures that all clinicians are using outcome measures and the same ones so that over time there will be significant data available. It also helps to ensure equity of service for all children so that children receive optimal and consistent care across all sites.*

- *There is always a 'learning curve' with new tools both in terms of administration and clinical utility. It is my opinion that as clinicians become more comfortable with the tools the speed with which they complete the protocol improves and the insight into the limits to uptake will be improved. It will therefore become important to reassess the protocol after a period of consistent implementation to evaluate the need for adjustments.*

5.4.4 Acceptability/Applicability

When developing measurement tools for use it is imperative that suitability for clinical application is considered. The acceptability/applicability section of the questionnaire to evaluate the UWO PedAMP consisted of 19 items. The items aimed to evaluate the UWO PedAMP documentation, training materials as well as the clinical application of UWO PedAMP components. Results are shown in Table 5-6. The majority of pediatric audiologists (93%) agreed that, overall, the UWO PedAMP was suitable as the 'norm' or standard of care for clinical use, was acceptable and beneficial to families in their care, and improved the clinical treatment for children with hearing loss aged birth to 6 years of age.

The UWO PedAMP training materials include written documentation accompanied by case examples and a training DVD/CD. The inclusion of a training DVD/CD was requested by Network audiologists during their initial evaluation of the UWO PedAMP (Moodie, Bagatto et al., 2011). The training DVD/CD was developed based on successful training sessions of the UWO PedAMP provided to the Ontario Infant Hearing Program audiologists. Results indicated that most audiologist respondents (86%) agreed that the UWO PedAMP manual in combination with the DVD/CD training video were produced in such a way that novice and experienced pediatric audiologists should be able to implement the UWO PedAMP into clinical practice after reviewing them. An equal number of respondents (79%) agreed that the case examples provided in the training materials facilitated development of the knowledge and skills required for use of the UWO PedAMP in practice and that the training materials along with the DVD/CD could be used in place of in-person training. There were several respondents (14%) who indicated that from their perspective in-person training was important for learning how to implement the UWO PedAMP.

Several respondents noted that although the training video presented valuable information to move the UWO PedAMP into practice, it was lengthy to watch and was delivered at "too slow of a pace."

As reported above, from an overall perspective, the UWO PedAMP was suitable for use as the standard of care, however, based on the number of respondents selecting the 'neutral' category (neither agree nor disagree) respondents are less sure of its suitability as the 'norm' / standard from a time (36% chose the neutral category) perspective and/or whether it would receive widespread acceptance by their colleagues (43% chose the neutral category). Approximately one-third of respondents (29%) also chose the neutral category when asked for their perspective on whether or not the UWO PedAMP was too rigid to apply to individual patients.

Table 5-6: Level of agreement with statements related to the suitability or use of the UWO PedAMP as the 'norm' or standard in clinical practice.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The training manual is acceptable on its own (without the DVD/CD) for learning how to incorporate the UWO PedAMP into clinical practice	57	21	21
The training DVD/CD is a beneficial addition along with the written training manual for learning how to incorporate the UWO PedAMP into clinical practice	86	14	0
The training manual + training DVD/CD can be used in place of in-person training	79	7	14
The training manual + training DVD/CD are best used together for learning how to incorporate the UWO PedAMP into clinical practice	57	36	7
The training manual + training DVD/CD are produced in such a way that even inexperienced or novice pediatric audiologists should be able to implement the UWO PedAMP into clinical practice after reviewing them	86	7	7

Table 5-6 continued: Level of agreement with statements related to the suitability or use of the UWO PedAMP as the 'norm' or standard in clinical practice.

Item	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The environment in which I work will make it difficult to use the UWO PedAMP	7	21	71
The time that it takes to administer the components of the UWO PedAMP will negatively affect other areas of pediatric audiological practice	14	36	50
The UWO PedAMP is too rigid to apply to individual patients	0	29	71
The training manual + training DVD/CD help build my confidence about initiating the UWO PedAMP in my clinical practice	57	29	14
The case examples provided within the UWO PedAMP manual will facilitate development of knowledge and skills for use of the UWO PedAMP in clinical practice	79	21	0

5.4.4.1 Select comments by Network audiologists regarding acceptability/applicability of the UWO PedAMP

- *At my site (numerous audiologists and support staff) it is not so much an issue of time/feasibility; it is a matter of convincing the team that the tools are appropriate for use on ALL hearing losses. There have been some concerns that using the questionnaires on certain types of hearing loss (e.g., mild, unilateral, high-frequency) might actually hinder the family's acceptance of amplification (e.g., if the family doesn't see any problems when the child is unaided, it may be harder to convince them of the importance of amplification). The general consensus is that it's an excellent tool, in most cases. … I do not feel that, at this time, management would require all staff to incorporate it....*

- *The present protocol is a good place to start. … it will become important to review the protocol and tools as clinical experience with various 'difficult to assess' children improves. I would anticipate that tools may need to be modified or different 'norms' developed for children with multiple challenges.*

5.4.5 Interpretability

For the four items associated with the category interpretability, respondents were asked to reflect on clinical interpretation and relevancy of the UWO PedAMP test results. Pediatric audiologists agreed that the results from the UWO PedAMP were relevant for clinical practice (93%), and also agreed (≥ 93%) that interpretation of results was straightforward and facilitated by the normative data provided in the documentation. Results are shown in Table 5-7. More respondents agreed (86%) that the aided speech intelligibility index (SII) and the LittlEARS questionnaire were able to provide information relative to a clinically meaningful change in performance than was provided with the PEACH.

Table 5-7: Level of agreement with statements related to clinical interpretation and relevancy of the UWO PedAMP results.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Results from the UWO PedAMP are relevant for clinical practice	93	7	0
It will be/is straightforward to clinically interpret the results of the _____:	**Agree to Agree Strongly (%)**	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Aided Speech Intelligibility Index (SII)	100	0	0
LittlEARS Auditory Questionnaire	100	0	0
Parents' Evaluation of Aural/Oral Performance in Children (PEACH)	93	7	0
Normative data provided will facilitate clinical interpretation of the _____:	**Agree to Agree Strongly (%)**	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Aided Speech Intelligibility Index (SII)	93	7	0
LittlEARS Auditory Questionnaire	100	0	0
Parents' Evaluation of Aural/Oral Performance in Children (PEACH)	100	0	0
Clinically meaningful change can be determined from the results of the _____:	**Agree to Agree Strongly (%)**	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Aided Speech Intelligibility Index (SII)	86	14	0
LittlEARS Auditory Questionnaire	86	14	0
Parents' Evaluation of Aural/Oral Performance in Children (PEACH)	71	29	0

5.4.5.1 Select comments by Network audiologists regarding clinical interpretation/relevancy of the UWO PedAMP

- *The PEACH provides less detailed information about auditory behaviours. Clinical interpretation of the information does not provide as clear a sense of what the next steps should be for that child in many cases.*

- *I think we will encounter some cases where there will be inconsistencies in the overall picture provided by PedAMP results - e.g., we may get cases where the fitting is appropriate, parents report good satisfaction and good usage but functional assessment results fall short. These cases will be challenging because we will need to learn how to effectively and sensitively probe more deeply in the issues that may be affecting outcome (e.g., latent language disability, inaccurate parental reporting).*

- *The data in the PedAMP speaks for itself. Clinical practice has clearly driven this product.*

5.4.6 Clarity

Respondents agreed (85%) that the UWO PedAMP presented options for treatment based on the test results, with the remaining 15% of respondents indicating that they neither agreed nor disagreed that the UWO PedAMP presented options for treatment based on the test results.

5.4.6.1 Select comments by Network audiologists regarding clarity of the UWO PedAMP

- *Not really sure. I think it will depend on the context and probably additional information will be needed to identify treatment options. For example, in cases of making decisions whether a child should get a cochlear implant, the UWO PedAMP will help but will not provide the full picture - we will need input from the multidisciplinary team.*

- *The Frequently Asked Questions are good for presenting options for treatment and interpretations of scores in light of other issues (e.g., developmental delays). It was just noted that the answer to #13 of the PEACH (how often does your child respond to sounds other than voices) may be interpreted a couple of different ways by parents and may not reflect function in "noise", which may alter the score on the PEACH, and may affect interpretation of the two scales.*

5.4.7 Recommendation that the UWO PedAMP be implemented for use in clinical practice; as part of preferred practice; and likelihood of use in daily practice

Tables 5-8, 5-9, and 5-10 provide results from the Network audiologists' level of agreement with practice implementation statements. Eighty-six (86%) of respondents agreed that the UWO PedAMP should be implemented as part of preferred audiology practice, however, only 64% would strongly recommend its use. The remaining 36% would recommend its use in clinical practice if alterations/modifications were made. In its current form (at the time of evaluation), 79% of responding Network audiologists reported that they would likely make use of the UWO PedAMP in their daily practice. The remaining 21% were moderately likely to use it on a daily basis.

Table 5-8: Level of agreement with statements related recommendation that the UWO PedAMP be implemented as part of preferred practice.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The UWO PedAMP should be implemented as part of preferred pediatric audiology practice	86	14	0

Table 5-9: Level of recommendation that the UWO PedAMP for use in clinical practice.

Item	Level of Recommendation (n=14)			
	Strongly Recommend (%)	**Recommend with Alterations (%)**	**Would Not Recommend (%)**	**Unsure (%)**
In its current form (as you have reviewed it today) would you recommend the UWO PedAMP for use in clinical practice?	64	36	0	0

Table 5-10: Level of likelihood that the UWO PedAMP will be used in daily practice.

Item	Level of Recommendation (n=14)		
	Very Likely (%)	**Moderately Likely (%)**	**Not Likely At All (%)**
In its current form (as you have reviewed it today) how likely would you be to make use of the UWO PedAMP in your daily practice?	79	21	0

5.4.7.1 Select comments by Network audiologists regarding recommendation that the UWO PedAMP be implemented for use in clinical practice

- *Yes, the PedAMP has been developed taking into account many factors including the quality of the evaluation tools, method of evaluation and clinical practice considerations. Implementation of this protocol as preferred practice in audiology would be a significant step toward ensuring consistent use of outcome evaluation tools in clinical practice.*

- *I would like more of an opportunity to use the tool and for others on our staff to use before recommending its incorporation into a preferred practice guideline.*

5.4.8 Barriers to implementation of the UWO PedAMP

This section of the questionnaire aimed to identify barriers that might impede clinical uptake of the UWO PedAMP. It consisted of nineteen items, an open-ended comment section and a request for participants to identify from their perspective the top five barriers to implementation. Results are shown in Tables 5-11 and 5-12. From the list of potential barriers provided, this group of Canadian pediatric audiologists reported that lack of authority to begin implementation, the need for additional support from 'experts', and the availability of translated materials should be considered as potential barriers to implementation. Most of the audiologists (~ 80%) did not see the items provided in the questionnaire list as considerable barriers to implementation. The most commonly self-reported barrier to implementation was related to time. Other self-reported barriers which might impede implementation of the UWO PedAMP in clinical practice were related to parental language, compliance, need to complete another clinical form; and professional/collegial commitment to incorporating these measures into practice.

Table 5-11: Level of agreement with statements related to the extent to which barriers impede / reduce clinical uptake / implementation of the UWO PedAMP.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	Neither Agree nor Disagree (%)	Disagree to Disagree Strongly (%)
I lack the authority in my work setting to begin implementation of the UWO PedAMP	14	14	64
I will require support from 'experts' in addition to the manual + training DVD/CD which have been provided in order to implement the UWO PedAMP in my practice	21	0	79
Although the UWO PedAMP has been translated into numerous languages, the translations that I require for the majority of my patients are not available	14	7	71
There is insufficient time where I work to implement the UWO PedAMP in clinical practice	7	14	79
The parent will not take the time to complete the UWO PedAMP	7	14	79
From a staff time-cost perspective, the UWO PedAMP will be too costly to implement in my clinical practice	0	21	79
I do not have colleagues I could go to for support when initiating the UWO PedAMP in clinical practice	0	21	71
It will be too costly to set up my/our clinical to perform the UWO PedAMP	0	21	79
After reviewing the manual + training DVD/CD, I still feel that I do not have the necessary skills to implement the UWO PedAMP in my clinical practice	7	0	86
I do not feel confident about initiating use of the UWO PedAMP in my clinical practice	7	7	86

Table 5-11 continued: Level of agreement with statements related to the extent to which various barriers impede / reduce clinical uptake / implementation of the UWO PedAMP.

Item	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
The colleagues in my work setting will not be receptive to implementing the UWO PedAMP in clinical practice	0	14	86
There is not enough leadership at my workplace to implement the UWO PedAMP in clinical practice	0	14	86
Implementation of the UWO PedAMP will require too many organizational changes where I work	0	14	86
The UWO PedAMP is too time-consuming to incorporate into clinical practice	0	14	86
There is lack of institutional support where I work to implement the UWO PedAMP	0	14	86
I will require hands-on training in addition to the manual + training DVD/CD which have been provided in order to implement the UWO PedAMP in my practice	7	0	93
The UWO PedAMP is too complex to incorporate into clinical practice	0	7	93
Manager(s)/Administrator(s) in my work setting will not be receptive to implementing the UWO PedAMP in clinical practice	0	7	93
The parent will not be able to perform the tasks required of him/her to complete the UWO PedAMP	0	7	93

Table 5-12: List of top five barriers to implementing the UWO PedAMP self-reported by clinicians.

Barrier 1	Barrier 2	Barrier 3	Barrier 4	Barrier 5
clinical time frames	parent difficulty in completing the evaluation tools			
full endorsement by management	time			
clinical value for time	clinical value for cost			
availability of translations for parent questionnaires				
sufficient time to learn the protocol and implement it consistently- particularly at the start of implementation	establishing comfort with all of the tools	establishing comfort with interpretation and scoring of all tools	administrative support to implement procedure	parental support with new measures to complete
parent compliance				
time to get it all organized in the clinic. Once organized. No problem.	having it standardized across the clinic	I don't have the authority to make people do it.		
perceived lack of time	need for training	need for clinical experience with tool to become comfortable	need to enhance computer information system to document (actually this is a biggie and should be up there with #1)	need to promote more buy-in by clinicians
frequency of use (every appointment)	parent report			
time within the appointment - need to rethink how to allocate time within the appointment				
no time to read protocol to implement it-took me 2 hrs to watch video and 1 to read manual	billable? Will parents only receive these services if they pay?	lack of professional desire to learn new things and improve practice	time constraints in clinic if you do not have input into your own scheduling	not seeing enough pediatric patients to become familiar with protocol

Table 5-12 continued: List of top five barriers to implementing the UWO PedAMP self-reported by clinicians.

Barrier 1	Barrier 2	Barrier 3	Barrier 4	Barrier 5
time constraints	parental attention to questionnaire while trying to manage their child			
time to read through the binder	time to coordinate doing PedAMP with recall times	time to upload to electronic filing		

5.4.9 Facilitators to implementation of the UWO PedAMP

Facilitation strategies assist or enhance clinical uptake of guidelines. A list of 12 potential facilitators was provided to the Network respondents to consider. Results in Table 5-13 suggest that having supportive colleagues, administrators, and experts to answer questions in a timely manner might be the best facilitation strategies to assist clinical uptake of the UWO PedAMP. Table 5-14 provides the results of the self-reported list provided by respondents when queried about their top five facilitators for moving the UWO PedAMP into practice. Results indicated that personal commitment to change and support from managers and from experts in the field would all facilitate implementation. Results also indicated a preference for continued consideration by researchers for computer-assisted administration/scoring/reporting, and modifications to recommendations of how often the UWO PedAMP has to be administered to parents.

Table 5-13: Level of agreement with statements related to the extent to which various facilitators assist/enhance clinical uptake / implementation of the UWO PedAMP.

Item	Level of Agreement (n=14)		
	Agree to Agree Strongly (%)	Neither Agree nor Disagree (%)	Disagree to Disagree Strongly (%)
Audiologists where I work are supportive of my implementing the UWO PedAMP	93*	0	0
Managers/administrators where I work are supportive of my implementing the UWO PedAMP	86	14	0
Making a personal commitment to implement the UWO PedAMP will facilitate implementation	86	14	0
Getting timely feedback from expert(s) when I have a question will facilitate implementation of the UWO PedAMP	71	14	14
Having managers/administrators understand the benefits of the UWO PedAMP will facilitate implementation	64	29	7
Developing more knowledge about the UWO PedAMP will facilitate implementation	43	21	36
Having trained 'leaders' onsite will facilitate implementation of the UWO PedAMP	36	43	21
In addition to the manual and training DVD/CD, receiving hands-on training will facilitate implementation of the UWO PedAMP	29	28	43
Additional flowcharts on use of the UWO PedAMP will facilitate clinical implementation	21	50	29

* Only 93% of audiologists (13/14) answered this question (some may have been in private practice/sole practitioner positions so chose not to respond).

Table 5-13 continued: Level of agreement with statements related to the extent to which various facilitators assist/enhance clinical uptake / implementation of the UWO PedAMP.

Item	Level of Agreement		
	Agree to Agree Strongly (%)	**Neither Agree nor Disagree (%)**	**Disagree to Disagree Strongly (%)**
Having someone assist me with additional skill development to perform the UWO PedAMP will facilitate implementation	21	36	43
Having administrators/managers/program evaluators examine my client files to see (audit) if I'm using the UWO PedAMP will facilitate implementation	14	29	57
Having an expert observe to me ensure that I am performing the measurement tools properly will facilitate implementation	29	14	57

Table 5-14: List of top five facilitators to implementing the UWO PedAMP self-reported by clinicians.

Facilitator 1	Facilitator 2	Facilitator 3	Facilitator 4	Facilitator 5
the knowledge that outcome measures are essential to clinical practice	the knowledge that completion of outcome measures will improve outcomes for the child and family	consistent clinical practice resulting in more consistent clinical service provision		
management support				
because we have to	if the paper work is not done, I get the file back			
having trained leaders on site to go to with questions and to seek support				
administrative support for implementation	the valuable information provided by the protocol from a clinical perspective	the ease of administration	clear instructions regarding administration	parent and/or colleague acceptance of new tools
simplicity	immediate benefit	all the support available		
hands on training by an expert	easily available decision support person that we can contact for advice	regular debriefing/rounds at practice meetings to support learning as we get used to the tool	seeing how much it benefits patients	support from higher levels of management and audit process
personal commitment	support from colleagues	support from managers	incorporated into site protocols	
making a personal commitment to attempt to implement the UWO PedAMP will be the greatest facilitator				
personal dedication to the program	organization-have forms at the ready and use the summary sheet	someone to contact for questions	perhaps roll out the components one at a time rather than all at once	prepare charts ahead of time similar to #2

Table 5-14 continued: List of top five facilitators to implementing the UWO PedAMP self-reported by clinicians.

Facilitator 1	Facilitator 2	Facilitator 3	Facilitator 4	Facilitator 5
hands-on training session				
quick access/response for when have questions	managerial support for extra time for session			

5.4.9.1 Select comments by Network audiologists regarding facilitators to implementation of the UWO PedAMP

- *Summary or flow chart so I can get started before having to find time to read through binder. Being presented with the binder is intimidating as to getting started.*
- *I think making compliance with outcome measures part of clinicians' performance evaluations is an excellent method of ensuring compliance with protocols.*
- *Because we have to*

5.4.10 Suggested Revisions/Modifications/Additions to the UWO PedAMP

The following were the most frequently provided suggestions for revisions to the first version of the UWO PedAMP.

- decrease the frequency at which the UWO PedAMP components need to be administered;
- continue to evaluate the PEACH to determine if it is the most appropriate tool for inclusion, or if it could be modified/replaced over time;
- consider additions to the hearing aid fitting summary sheet such as a place where the programs which have been saved to the hearing aid memories can be entered;
- consider using a more parent friendly term than ‘comorbidities’ in documentation; perhaps something like ‘additional special needs’;

- consider a shorter quick-start version of the manual/training binder;
- the LittlEARS is considered a good outcome evaluation tool, but paying a fee to use it in clinical practice is a barrier; non-fee for use would facilitate implementation.

The following additions to future versions of the UWO PedAMP were suggested by respondents:

- helpful information on how to apply or interpret test scores / counsel parents in special cases such as when the child has: bone-anchored devices; mild or unilateral hearing loss; frequency-lowering devices; hearing aid plus cochlear implant; is waiting for a cochlear implant but wearing a hearing aid; and in the cases of auditory neuropathy spectrum disorder;
- electronic sharing of data for pediatric audiologists using the UWO PedAMP and shared case examples;
- the UWO PedAMP would benefit by inclusion of tools for continued evaluation as children get older, especially as the measures relate to psycho-social development;
- the UWO PedAMP might benefit from inclusion of objective speech measures;
- include additional sample recommendations for when children score below the 95^{th} confidence interval on the LittlEARS or PEACH; or score 27 on LittlEARS but low on the PEACH;
- the UWO PedAMP would benefit from additional normative and performance-related data for the PEACH;
- inclusion of a sheet that provides the audiologist with a place to document more hearing aid related information would be helpful (for example, recording serial number, memory settings, and a checklist to make sure that the parents have been provided with all the appropriate information required as they begin using amplification).

5.4.10.1 Select comments by Network audiologists regarding suggested revisions to the UWO PedAMP

- *I recommend that the PEACH outcome measure be evaluated over time to determine if it is effective at providing information that will benefit the child. In some cases, I question whether the tool informs the clinician in a manner that leads to change in care or service provided. I would like to see a more detailed evaluation like the LittlEARS that assesses auditory behaviour in the 2-6 year age range with items that relate specifically to auditory development.*

- *At our site we see children every three months in the first year after a diagnosis of a hearing loss. I think it would be good to allow some clinical discretion for exceptions to administering the LittlEARs and/or PEACH at every appointment.*

- *I would recommend being cautious when implementing the protocol in certain situations (mild HL* [hearing loss]*, unilateral HL, and high frequency HL) in order to avoid negatively influencing the parents on the benefit of amplification in these cases where a change might not be observed in the questionnaire results pre and post fitting.*

- *There are challenging cases that do not 'fit' into the current protocol and subsequently cannot be assessed with the same level of focus. For example, children fit with bone-anchored devices- completion of the SII is not possible. Could the PedAMP protocol provide some suggestions for how to proceed with this group? Other groups might include mild, unilateral hearing loss- to fit or not to fit? I am also interested in finding a systematic way of assessing children with ANSD* (auditory neuropathy spectrum disorder) *who cannot be conditioned sufficiently using VRA* (visual reinforcement audiometry)*. Could we explore a 'controlled' series of noise-making toys (or something similar) that would permit some sense of the degree of hearing loss in these challenging cases?*

5.5 Partnership experience for Network of Pediatric Audiologists of Canada

This section of the questionnaire focused on evaluating the partnership experience for the audiologists within the Network across Canada. Results indicated that the majority of the Network audiologists (≥ 92%) who responded to the final questionnaire (n=14) believed that their participation in this project increased the impact that the UWO PedAMP would have in clinical practice compared to what it would have been if researchers had developed it without their input. The same percentage (≥ 92%) reported that in their opinion this partnership increased the potential for clinical uptake of the UWO PedAMP. Finally, all respondents (100%) reported that they would work again in this partnership to create new knowledge or to undertake other research studies. The greatest challenge to participation on the UWO PedAMP project experienced by the Network audiologists was the time commitment. They reported that it was a challenge to find the amount of time in their daily practice and lives to: carefully review the materials the researchers asked them to; provide timely feedback; try them out in practice; and then evaluate the complete UWO PedAMP guideline binder and watch the training DVD/CDs. Finally, despite the reported challenges, 93% of the Network audiologists indicated that their clinical practice had benefited from participation in the Network of Pediatric Audiologists of Canada and in the UWO PedAMP project.

5.5.1.1 Select comments by Network audiologists regarding partnership

- *Absolutely!!! I found that being a part of the process, and being able to provide constructive suggestions about how to modify the process, has certainly helped me to accept the protocol with full support.*

- *The information was gathered from a variety of clinical settings with different populations and sub-cultures. Therefore, receiving input from a large, national network increases its applicability to a variety of clinics, and will increase its acceptability into clinical practice in clinics across Canada.*

- *Knowing that other clinicians find it feasible and practical in their clinics makes it easier to see how it would be feasible in our own clinics as well.*

- *It was based on what front line people wanted, and that was great!*

5.6 Discussion

Research has shown that implementation of evidence into health care practice is not accomplished simply by creating knowledge and disseminating it to practicing clinicians (Straus et al., 2009). This is also true for the profession of audiology (Bess, 2000; Kirkwood, 2010; Kochkin et al., 2010; Kochkin, 2011; Lindley, 2006; Mueller, 2003; Mueller & Picou, 2010; Strom, 2006, 2009). The overall objective of this project was to actively collaborate with pediatric audiologists and use the knowledge to action process (Graham et al., 2006; Graham & Tetroe, 2007; Straus et al., 2009) to develop an outcome measures guideline to evaluate the auditory development and performance of children with permanent childhood hearing impairment (PCHI) who wear hearing aids and are aged birth to six years that would be recommended for use in clinical practice (Bagatto, Moodie, Malandrino et al., 2011; Bagatto, Moodie, Seewald et al., 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011). We submit that the primary advantages of utilizing a knowledge-to-action process during guideline development is that pediatric audiologists (knowledge users) will bring their shared understanding of the knowledge needed and have the ability to assist in tailoring or customizing the guideline for better use among audiologists within the complex contexts in which they work (Fung-Kee-Fung, Watters, Crossley, & Thomas, 2009; Gajda & Koliba, 2007; Koliba & Gajda, 2009; Moodie, Kothari et al., 2011; Salisbury, 2008a; 2008b; Stahl, 2000).

Overall, the results of the final evaluation of the UWO PedAMP v1.0 demonstrate that the process of using a collaborative approach recommended by the knowledge-to-action framework resulted in the creation of a tailored guideline that would, in the opinion of the Network audiologists, be translated into action in practice. Results generally indicate that the Network audiologists believe the UWO PedAMP to be a high-quality, systematic, hearing aid outcome evaluation tool that improves the quality and effectiveness of

audiological care received by young children with hearing loss and their families. These results are similar to those obtained in other studies where active participation of practitioners and a CoP approach were considered essential components to the development of guidelines that changed practice and improved quality care in surgical oncology practices in the province of Ontario (Browman & Brouwers, 2009; Browman, Makarski, Robinson, & Brouwers, 2005; Evans et al., 2006; Stern et al., 2007). The majority of respondents (≥ 79%) to the current survey report that the length of time it would take to administer, score, interpret results and counsel parents is appropriate for incorporation of the UWO PedAMP into routine clinical practice. Interpretation of test results is facilitated by the normative data in the documentation provided, and assists parents and audiologists in decision-making. In the opinion of the responding audiologists, the UWO PedAMP documentation and training materials/DVD/CD have been produced in such a way that many novice and experienced practitioners should be able to implement the UWO PedAMP after reviewing them.

The UWO PedAMP reflects a more clinically effective approach to evaluating auditory development and performance than what the Network audiologists are currently doing in practice. As reported in Moodie, Bagatto et al. (2011), audiologists were using a wide variety of outcome measures in clinical practice, indicating a lack of consistent battery of outcome evaluation tools for the evaluation of auditory development of children aged birth to six years with PCHI who wear hearing aids. Many of the tools being used would not be administered during routine audiological appointments and would be administered by other professionals associated with their audiology department (for example, auditory-verbal therapists and/or speech-language pathologists). Some of the measures listed by respondents would have been more useful with children six years of age or older, while others primarily assessed speech and language development.

Eighty-six percent of respondents indicated that the UWO PedAMP v1.0 should be implemented as part of preferred audiology practice.

Thirty-six percent of respondents indicated that they would like to continue to see alterations to the UWO PedAMP considered. The UWO PedAMP evaluation

questionnaires included in this study were developed not only to provide audiologists with items for consideration, but also to provide them with an opportunity to comment on all aspects considered important for clinical implementation. As documented throughout the results section, the audiologists provided valuable and rich written input for consideration for implementation as well as for future revisions/development of the UWO PedAMP. Some of the primary areas of concern related to clinical feasibility, acceptability/applicability and interpretability.

From a clinical feasibility perspective, time to implement the UWO PedAMP in practice is still a concern for some of the audiologists. Time, as an issue for busy health care professionals, is almost always cited as the biggest barrier to implementing improvements in practice. In a systematic review of barriers to research utilization, Kajermo et al. (2011) found that 72% of the examined studies had more than half the nurses rating time to read research and time on the job to implement new ideas as moderate to great barriers to implementation of evidence into practice. Speech-language-pathologists and occupational therapists also reported that time to read and/or time to implement evidence into practice are the greatest barriers to research utilization (Salls, Dolhi, Silverman, & Hansen, 2009; Zipoli & Kennedy, 2005).

The Network audiologists suggest that researchers and organizations consider computer-assisted implementation for the UWO PedAMP. This would provide a method for delivering the outcome measures to parents in an electronic form, in the appropriate language translation, that parents might complete in the waiting room or at other sites (e.g., via secure web-based delivery at home). It would also enable automatic scoring, report generation, and data base summaries, that, in the opinion of the audiologists, would reduce: the amount of time they may need to spend with the parent(s) while they completed the forms; on scoring paper-based tests; transferring the data to a computer based database; and producing a report for counseling purposes. They also proposed that computer-assisted implementation might facilitate quality-control measures for program evaluation purposes. These suggestions are worthy of consideration. Computer-assisted informatics systems are being advocated in health care practices. They have been shown to enhance health care by improving provider functions and assisting with decision-

making by professionals and patients (Gupta & McKibbon, 2009). It could be the case that audiologists' use of the UWO PedAMP in daily practice could be improved by computer-assisted implementation. Research evidence indicates that use and adherence to guidelines by physicians improved when they were available in a computerized format (Trivedi, Kern, Grannemann, Altshuler, & Sunderajan, 2004). Although not without some criticism (Westbrook et al., 2009), computer-based implementations of health-related measures have been shown to consistently and accurately summarize data and present it in a useful and timely fashion (Bliven, Kaufman, & Spervus, 2001). Informatics systems have been developed that will also provide organization and self-directed chart audit utilities to measure clinician performance against practice benchmarks, as well as other program-related outcomes (Ho et al., 2004).

Audiologists expressed concern that the time it takes to implement the UWO PedAMP may negatively affect other areas of pediatric audiological practice. It is true, especially in pediatric health care practices, that appointment times are never long enough, parents are often late, and children are often non-cooperative. This causes stress for pediatric practitioners as they try to balance the challenge of 'best practice' and the reality of daily clinical life. It will be important as the UWO PedAMP is implemented in practice, that use in various clinical contexts is monitored, so that data can be collected about time to implement the tools, and the impact on daily practice. By monitoring this, and working collaboratively with clinicians, strategies (like computer-assisted implementation) may be developed to assist with the practice 'trade-off' dilemma.

Audiologists also expressed concern that parents may struggle trying to interpret questions and relate experiences with their child to the questions on the forms. In addition, many found that an interview style format was often required when administering the questionnaires to parents where English was their second language and translated materials or access to an interpreter were not available to the clinician. Interview style administration was more time-intensive for the audiologists. Working with patients with varied multicultural and multilingual backgrounds presents challenges for healthcare professionals who primarily speak English. In a recent study of Colorado speech-language pathologists completed by Guiberson & Atkins (2010), approximately

81% of the respondents reported that not speaking the client's language was challenging, and more than half indicated that the lack of access to interpreters also presented clinical practice challenges. Only 21% of respondents in the Guiberson & Atkins study had received coursework in how to utilize an interpreter. Availability of appropriately translated materials was an important consideration voiced by the Network audiologists during development of the UWO PedAMP (Moodie, Bagatto et al., 2011). During the initial evaluation stage we were provided with lists of languages that the pediatric audiologists wished to have the LittlEARS and PEACH translated into for clinical release. The LittlEARS Questionnaire is available in numerous languages (see www.medel.com). In part, based on the requests from our collaborations with pediatric audiologists we have created translations (if they were not already available) in the following languages: Bengali, Farsi, Gujarti, Mandarin/Chinese, Somali, Tamil, Urdu and Vietnamese. This should facilitate uptake especially in large urban areas. It is important to reiterate, and has been reported as a barrier to implementation, that the LittlEARS Auditory Questionnaire is copyright protected and must be purchased directly from the Med-El Medical Electronics Co.

The contexts in which some pediatric audiologists work may make it difficult to begin to apply the UWO PedAMP in practice primarily because of the focus on standard operating procedures and behavioural norms (Rosenheck, 2001). Some of the Canadian audiologists in this study cited lack of authority to begin implementation of the UWO PedAMP in practice as a barrier. The importance of leadership and the use of Network audiologists as knowledge brokers within the practice context could assist in intervening for change to take place (Aarons, 2006; Cummings et al, 2007; Masso and McCarthy, 2009).

Although pediatric audiologists agreed that the results from the UWO PedAMP were relevant for clinical practice, and also agreed that interpretation of results was straightforward and facilitated by the normative data provided in the documentation, they also expressed some concerns especially related to the PEACH rating scale. Similar concerns regarding clinical use of the PEACH were reported in the initial evaluations of the tools (Moodie, Bagatto, et al., in press). Some audiologists suggested that the

researchers continue to evaluate the PEACH to determine if it is the most appropriate tool for inclusion, or if it could be modified/replaced over time. They also had more difficulty clinically interpreting the results of the PEACH and what the treatment option steps should be based on the results of the questionnaire. This difficulty in clinical interpretation of results and meaningful determination of treatment options was more evident for children with mild, minimal hearing loss, unilateral hearing loss, as well as when the children presented with multiple complex needs in addition to their hearing loss.

The UWO PedAMP researchers are paying close attention to the expressed concerns during ongoing development of the UWO PedAMP. Like other guidelines, the UWO PedAMP is a 'living document' that should evolve as new evidence emerges (Browman, 2000). We expect that this collaboration with the Network of Pediatric Audiologists of Canada to continue and hope to partner with the audiologists to obtain additional data to support clinical use of the tools, as we move to a more wide-spread clinical implementation stage of the UWO PedAMP.

5.7 Study limitations

The results of this study need to be considered in light of the fact that not all of the members of the Network of Pediatric Audiologists of Canada who participated in the initial evaluation of the individual components of the UWO PedAMP (Moodie, Bagatto et al., 2011) completed the final evaluation of the UWO PedAMP. Completed initial evaluation study participation was 91%; participation in the final evaluation of the UWO PedAMP was 63%. A follow-up email sent by the lead author to Network members who did not complete a final evaluation found that time, job change (advancement to a new role within the organization), and maternity leave were reasons for non-completion. Three Network members could not be contacted prior to the writing of this article to obtain this information, so it is unknown exactly why they did not complete the final evaluation.

The survey developed for this study aimed to provide items for audiologists' consideration that would be important to clinical implementation of a guideline into practice. These included items associated with quality, feasibility, clinical value, applicability, clarity, interpretability, barriers and facilitators to implementation, recommendations for revisions, modifications and additions. A psychometric evaluation was not conducted prior to using the questionnaire. This evaluation may have led to revision of some of the questions included. We hoped to reduce this limitation by providing audiologists with comment sections at the end of each item. The audiologists provided in-depth written comments that augmented our understanding of the study results.

Participants for this project were purposefully selected audiologists and/or pediatric audiology sites in Canada. Findings from this study may not reflect the views of all pediatric audiologists in Canada and may not generalize to other countries.

Relating results of this survey to potential for adherence to the guideline has to be done with some caution. As encouraging as the finding that 86% of respondents agreed that the UWO PedAMP should be implemented as part of preferred practice is, it appears that local adaptation and/or adherence issues may occur at the implementation stage because 36% of respondents would like to see alterations to the guideline made before they would strongly recommend its use. Adaptation of guidelines may enhance applicability and improve implementation. However, the process must preserve the integrity of the recommendations (Harrison, Graham, & Fervers, 2009).

5.8 Conclusion

Canadian audiologists working with young children with PCHI want to integrate evidence during the hearing aid fitting process and balance this with their clinical experience in obtaining important and valuable information from the families and young patients in their care (Moodie, Bagatto et al., 2011). Study results indicate that active collaboration with pediatric audiologists using the knowledge-to-action process resulted in the UWO PedAMP being developed collaboratively and rated by the Network

audiologists as a high-quality, systematic, hearing aid outcome evaluation tool that improves the quality and effectiveness of audiological care received by young children with hearing loss and their families, and is recommended for use in clinical practice. Participant audiologists provided several important recommendations for modifications, revisions and additions which would ultimately reduce the predicted barriers to implementation.

Future research should focus on evaluation of the UWO PedAMP v1.0 by audiologists who are not members of the Network, and who practice in other countries. In addition, as shown in Figure 5-1, the action cycle of the knowledge-to-action process would assert that the next stage of the process for this project would be an implementation stage. An implementation study may provide us with a better understanding of the strategies and interventions that would be necessary to effect change in practice behaviour at the individual and organization levels. An implementation study may also provide us with methods that will sustain ongoing knowledge use in clinical practice.

The Network of Pediatric Audiologists of Canada has been described as a developing community of practice (CoP; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011). Funding initiatives are being investigated to develop an e-based method for this community to interact so that they might share ideas, information, ways of knowing and experiences. It is also important for this CoP to continue to work collaboratively on the UWO PedAMP to ensure that continued development of the guideline reflects the knowledge and needs of audiologists in practice.

5.9 References

American Academy of Audiology Pediatric Amplification Guidelines. (2003). Retrieved from: http://www.audiology.org/resources/documentlibrary/Documents/pedamp.pdf

Aarons, G. A. (2006). Transformational and transactional leadership: Association with attitudes toward evidence-based practice. *Psychiatric Services, 57*, 1162-1169. doi:10.1176/appi.ps.57.8.1162

Bagatto, M. P., Moodie, S. T., Malandrino, A. C., Richert, F. M., Clench, D. A., & Scollie, S. D. (2011). The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP). *Trends in Amplification, 15*(1), 57-76. doi: 10.1177/1084713811420304

Bagatto, M. P., Moodie, S. T., & Scollie, S. D. (2010). *The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP): Version 1.0.* Child Amplification Laboratory, University of Western Ontario: London, ON.

Bagatto, M. P., Moodie, S. T., Seewald, R. C., Bartlett, D. J., & Scollie, S. D. (2011). A critical review of audiological outcome measures for infants and children. *Trends in Amplification, 15*(1), 23-33. doi: 10.1177/1084713811412056

Bagatto, M. P., Scollie, S. D., Hyde, M. & Seewald, R. (2010). Protocol for the provision of amplification in the Ontario Infant hearing program. *International Journal of Audiology, 49*, S70-S79. doi: 10.3109/14992020903080751

Bess, F. (2000). Early Amplification for Children: Implementing Change. In R. C. Seewald (Ed.), *A Sound Foundation Through Early Amplification: Proceedings of an International Conference* (pp. 247.251). Staffa, Switzerland: Phonak AG.

Bliven, B. D., Kaufman, S. E., & Spertus, J. A. (2001). Electronic collection of health-related quality of life data: Validity, time benefits, and patient preference. *Quality of Life Research, 10*(1):15-21. doi: 10.1023/A:1016740312904

Browman, G. P. (2000). Improving clinical practice guidelines for the 21st century: Attitudinal barriers and not technology are the main challenges. *International Journal of Technology Assessment in Health Care, 16*(4):959-968. Retrieved from: http://journals.cambridge.org/action/displayFulltext?type=1&fid=76782&jid=THC&volumeId=16&issueId=04&aid=76781

Brown, J. S., & Duguid, P. (2001). Knowledge and organization: A social-practice perspective. *Organization Science, 12*(2), 198-213. Retrieved from: http://www.business.aau.dk/ivo/news/background-BrownDuguid2001.pdf

Brouwers, M. C., Graham, I. D., Hanna, S. E., Cameron, D. A., & Browman, G. P. (2004). Clinicians' assessments of practice guidelines in oncology: the CAPGO survey. *International Journal of Technology Assessment in Health Care, 20*(4), 421-426. doi: 10.1017/S026646230400130

Browman, G. P., & Brouwers, M. (2009). The role of guidelines in quality improvement for cancer surgery. *Journal of Surgical Oncology, 99*(8), 467-469. doi: 10.1002/jso.21171.

Browman, G. P., Makarski, J., Robinson, P., & Brouwers, M. (2005). Practitioners as experts: The influence of practicing oncologists "in-the-field" on evidence-based guideline development. *Journal of Clinical Oncology, 23*(1), 113-119. doi: 10.1200/JCO.2005.06.179

Ceccato, N. E., Ferris, L. E., Manuel, D., & Grimshaw, J. M. (2007). Adopting health behavior change theory throughout the clinical practice guideline process. *The Journal of Continuing Education in the Health Professions, 27*(4), 201-207. doi: 10.10020chp.138

Ching, T. Y., & Hill, M. (2005a). The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Diary. Chatswood, New South Wales, Australia: Australian Hearing. Retrieved from: http://www.outcomes.nal.gov.au/Assesments%20&%20Resources/PEACH%20Final%20April%2006%20_foldable_.pdf.

Ching, T. Y., & Hill, M. (2005b). The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Rating Scale. Chatswood, New South Wales, Australia: Australian Hearing. Retrieved from: http://www.outcomes.nal.gov.au/LOCHI%20assessments.html

Cohen, A. M., Stavri, P. Z., & Hersh, W. R. (2004). A categorization and analysis of the criticisms of evidence-based medicine. *International Journal of Medical Informatics, 73*(35-43). doi: 10.1016/j.ijmedinf.2003.11.002

College of Audiologists and Speech-Language Pathologists of Ontario (2000). Preferred practice guideline for the prescription of hearing aids to adults. Retrieved from: http://www.caslpo.com/Portals/0/ppg/preshearingaidsadults.pdf.

College of Audiologists and Speech-Language Pathologists of Ontario. (2002). Preferred Practice Guideline for the Prescription of Hearing Aids to Children. Retrieved from: http://www.caslpo.com/Portals/0/ppg/preshearingaidschild.pdf.

Conklin, J., Kothari, A., Stolee, P., Chambers, L., Forbes, D., Le Clair, K. (2011). Knowledge-to-action processes in SHRTN collaborative communities of practice: A study protocol. *Implementation Science, 6*:12. doi: 10.1186/1748-5908-6-12

Cummings, G. G., Estabrooks, C. A., Midodzi, W. K., Wallin, L., & Hayduk, L. (2007). Influence of organizational characteristics and context on research utilization. *Nurse Researcher, 56*, S24-39. doi:10.1097/01.NNR.0000280629.63654.95

Damschroder, L., Aron, D., Keith, R., Kirsh, S., Alexander, J., & Lowery, J. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science, 4*:50. doi: 10.1186/1748-5908.4-50

Eccles, M., Grimshaw, J., Johnston, M., Steen, N., Pitts, N. B., Thomas, R., … Walker, A. (2007). Applying psychological theories to evidence-based clinical practice: Identifying factors predictive of managing upper respiratory tract infections without antibiotics. *Implementation Science, 2*:26. doi: 10.1186/1748-5908-2-26

Eccles, M. P., Johnston, M., Hrisos, S., Francis, J., Grimshaw, J., Steen, N., & Kaner, E. F. (2007). Translating clinicians' beliefs into implementation interventions (TRACII): A protocol for an intervention modeling experiment to change clinicians' intentions to implement evidence-based practice. *Implementation Science*, *2:*27. doi: 10.1186/1748-5908-2-27

Estabrooks, C. A., Floyd, J. A., Scott-Findlay, S., O'Leary, K. A., & Gushta, M. (2003). Individual determinants of research utilization: A systematic review. *Journal of Advanced Nursing 43*(5), 506-520. doi: 35400011433076.0090

Evans, W. K., Graham, I. D., Cameron, D., Mackay, J. A., & Brouwers, M. (2006). Practitioner feedback on lung cancer practice guidelines in Ontario. *Journal of Thoracic Oncology, 1*(1), 10-18.

Field, M. J., & Lohr, K. N. (1990). *Clinical Practice Guidelines: Directions for a New Program.* Washington, DC: Institute of Medicine, National Academy Press.

Fixsen, D., Naoom, S. F., Blase, K. A., Friedman, R. M., & Wallace, F. (2005). *Implementation Research: A synthesis of the literature*. Tampa, FL: University of South Florida, Louis de la Parte Florida Mental Health Institute, The National Implementation Research Network (FMHI Publication #231). Retrieved from: http://ctndisseminationlibrary.org/PDF/nirnmonograph.pdf

Francis, J. J., Tinmouth, A., Stanworth, S. J., & Eccles, M. P. (2009). Using theories of behaviour to understand transfusion prescribing in three clinical contexts in two countries: Development work for an implementation trial. *Implementation Science, 4,* 70. doi: 10.1186/1748-5908-4-70

Fung-Kee-Fung, M., Watters, J., Crossley, C., Goubanova, E., Abdulla, A., Stern, H., & Oliver, T. K. (2009). Regional collaborations as a tool for quality improvements in surgery: A systematic review of the literature. *Annals of Surgery, 249*(4), 565-572. doi: 10.1097/SLA.0b013e31819ec608

Gajda, R., & Koliba, C. (2007). Evaluating the imperative of intra-organizational collaborations: A school improvement perspective. *American Journal of Evaluation, 28*(1), 26-44. doi: 10.1177/1098214006296198

Gerrish, K., Ashworth, P., Lacey, A., Bailey, J., Cooke, J., Kendall, S., …McNeilly, E. (2007). Factors influencing the development of evidence-based practice: a research tool. *Journal of Advanced Nursing, 57*(3), 328-338. doi:10.1111/j.1365-2648.2006.04112.x

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The New Production of Knowledge*. London, UK: Sage Publications Ltd.

Glasgow, R., & Emmons, K. (2007). How can we increase translation of research into practice? Types of evidence needed. *Annual Review of Public Health, 28*, 413-433. doi:10.1146/annurev.publhealth.28.021406.144145

Graham, I. D., Logan, J., Harrison, M. B., … Robinson, N. (2006). Lost in knowledge translation: Time for a map? *The Journal of Continuing Education in the Health Professions, 26*, 13-24. doi: 10.1002/chp.47

Graham, I. D., & Tetroe, J. (2007). How to translate health research knowledge into effective health care action. *Healthcare Quarterly, 10*(3), 20-22.

Grol, R. (2001). Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Medical Care, 39*(8), Supplement 2, II-46-II54. Retrieved from https://ssl.fimmg.org/metis/prj/CONDIVISIONE/condivisionebpco_grol_med_care_2001.pdf

Guiberson, M., & Atkins, J. (2010). Speech-Language Pathologists' preparation, practices, and perspectives on serving culturally and linguistically diverse children. *Communication Disorders Quarterly,* published online 29 November, 2010. doi: 10.1177/1525740110384132

Gupta, S., & McKibbon, K. A. (2009). Informatics interventions. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 131-136). Hoboken: Blackwell Publishing Ltd.

Harrison, M. B., Graham, I. D, & Fervers B. (2009). Adapting knowledge to a local context. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 73-82). Hoboken NJ: Blackwell Publishing Ltd.

Harrison, M. B., Légaré, F., Graham, I. D., & Fervers, B. (2010). Adapting clinical practice guidelines to local contexts and assessing barriers to their use. *CMAJ, 182*(2), E78-E84. doi: 10.1503/cmaj.081232

Ho, K., Bloch, R., Gondocz, T., Laprise, R., Perrier, L., Ryan, D., ... Wenghofer, E. (2004). Technology-enabled knowledge translation: Frameworks to promote research and practice. *The Journal of Continuing Education in the Health Professions, 24*(2):90-99. doi: 10.1002/chp.1340240206

Joint Committee on Infant Hearing. (2007). Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. *Pediatrics, 120*(4), 898-921.

Joint Committee on Infant Hearing, American Academy of Audiology, American Academy of Pediatrics, American Speech-Language-Hearing Association, & Directors of Speech and Hearing Programs in State Health and Welfare Agencies. (2000). Year 2000 position statement: Principles and guidelines for early hearing detection and intervention programs. *Pediatrics, 106*(4), 798-817.

Kajermo, K. N., Boström, A. M., Thompson, D. S., Hutchinson, A. M., Estabrooks, C. A., & Wallin, L. (2010). The BARRIERS Scale - - the barriers to research utilization scale: A systematic review. *Implementation Science, 5*:32. doi:10.1186/1748-5908-5-32.

King, A. M. (2010). The national protocol for paediatric amplification in Australia. *International Journal of Audiology, 49*, S64-69. doi: 10.3109/14992020903329422

Kirkwood, D. H. (2010). Survey probes dispensers' views on key issues raised by *Consumer Reports*. *The Hearing Journal, 63*(5), 17-26. doi: 10.1097/01.HJ.0000373446.75826.e1

Kochkin, S. (2011). MarkeTrak VIII: Reducing patient visits through verification & validation. *Hearing Review, 18*(6), 10-12. Retrieved from http://www.hearingreview.com/issues/

Kochkin, S., Beck, D. L., Christensen, L. A., Compton-Conley, C., Fligor, B. J., Kricos, P. B., … Turner, R. G. (2010). MarkeTrak VIII: The impact of the hearing healthcare professional on hearing aid user success. *Hearing Review, 17*(4):12-34. Retrieved from http://www.hearingreview.com/issues/

Koliba, C., & Gajda, R. (2009). "Communities of Practice" as an analytical construct: Implications for theory and practice. *International Journal of Public Administration, 32*(2), 97-135. doi: 10.1080/01900690802385192

Lindley, G. (2006). Current hearing aid fitting protocols: Results from an on-line survey. *Audiology Today, 18*(3), 19-22. Retrieved from http://www.audiology.org/resources/audiologytoday/

Masso, M., & McCarthy, G. (2009). Literature review to identify factors that support implementation of evidence-based practice in residential care. *International Journal of Evidence Based Healthcare, 7*(2), 145-156. doi:10.1111/j.1744-1609.2009.00132.x

Michie, S., Fixsen, D., Grimshaw, J., & Eccles, M. (2009). Specifying and reporting complex behaviour change interventions: The need for a scientific method. *Implementation Science, 4*, 40. doi: 10.1186/1748/5908-4-40

Moodie, S. T., Bagatto, M. P., Miller, L. T., Kothari, A., Seewald, R. C., & Scollie, S. D. (2011). An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). *Trends in Amplification, 15*(1), 34-56. doi: 10.1177/1084713811417634

Moodie, S. T., Kothari, A., Bagatto, M. P., Seewald, R. C., Miller, L., & Scollie, S. D. (2011). Knowledge translation in audiology: Promoting the clinical application of best evidence. *Trends in Amplification, 15*(1), 5-22. doi: 10.1177/1084713811420740

Modernising Children's Hearing Aid Services (2007). Guidance on the use of real ear measurement to verify the fitting of digital signal processing hearing aids. Retrieved from: http://www.thebsa.org.uk/docs/RecPro/REM.pdf.

Mueller, H. G. (2003). In the words of Shakespeare: Fitting test protocols are “more honored in the breach than in the observance”. *The Hearing Journal, 56*(10), 19-26. Retrieved from http://www.journals.lww.com/thehearingjournal/

Mueller, H. G., & Picou, E. M. (2010). Survey examines popularity of real-ear probe-microphone measures. *The Hearing Journal, 63*(5), 27-32. Retrieved from http://www.journals.lww.com/thehearingjournal/

Mullen, E. J., & Steiner, D. L. (2004). The evidence for and against evidence-based practice. *Brief Treatment and Crisis Intervention, 4*, 111-121. doi: 10.1093/brief-treatment/mhh009

Murray, S. J., Holmes, D., & Rail, G. (2008). On the constitution and status of 'evidence' in the health sciences. *Journal of Research in Nursing, 13*(4), 272-279. doi: 10.1177/1744987108093529

Nutley, S., Walter, I., & Davies, H. T. O. (2003). From knowing to doing: A framework for understanding the evidence-into-practice agenda. *Evaluation, 9*(2), 125-148. doi: 10.1177/1356389003009002002

Quiros, D., Lin, S., & Larson, E. L. (2007). Attitudes toward practice guidelines among intensive care unit personnel: A cross-sectional anonymous survey. *Heart & Lung, 36*(4), 287-297. doi: 10.1016/j.hrtlng.2006.08.005

Ramsay, C., Thomas, R., Coral, B., Grimshaw, J., & Eccles, M. (2010). Using the theory of planned behaviour as a process evaluation tool in randomized trials of knowledge translation strategies: A case study from UK primary care. *Implementation Science, 5,*71. doi: 10.1186/1748-5908-5-71

Rosenfeld, R. M., & Shiffman, R. N. (2009). Clinical practice guideline development manual: A quality-driven approach for translating evidence into action. *Otolaryngology Head and Neck Surgery, 140*(6 Suppl. 1): S1-43. doi: 10.1016/j.otohns.2009.04.015

Rosenheck, R. (2001). Organizational process: A missing link between research and practice. *Psychiatric Services, 52*(12), 1607-1612. Retrieved from http://ps.psychiatryonline.org/

Rutten, G. M., Degen, S., Hendriks, E. J., Braspenning, J. C., Harting, J., & Oostendorp, R. A. (2010). Adherence to clinical practice guidelines for low back pain in physical therapy: do patients benefit? *Physical Therapy, 90*(8), 1111-1122. doi: 10.2522/ptj.20090173

Salisbury, M. (2008a). A framework for collaborative knowledge creation. *Knowledge Management Research and Practice, 6*, 214-224. doi: 10.1057/kmrp.2008.10

Salisbury, M. (2008b). From instructional systems design to managing the life cycle of knowledge in organizations. *Performance Improvement Quarterly, 20*(3-4), 131-145. doi: 10.1002/piq.20007

Salls, J., Dolhi, C., Silverman, L., & Hansen, M. (2009). The use of evidence-based practice by occupational therapists. *Occupational Therapy in Health Care, 23*(2), 134-145. doi:10.1080/07380570902773305

Shiffman, R.N., Dixon, J., Brandt, C., O'Connell, R., Essaihi, A., Michel, G., & Hsiao, A. (2005). *GLIA: GuideLine Implementability Appraisal v1.0*. New Haven, CT: Yale Center for Medical Informatics. Retrieved from: http://gem.med.yale.edu/glia/doc/GLIA_v1.pdf

Stahl, G. (2000). A Model of Collaborative Knowledge-Building. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Fourth International Conference of the Learning Sciences* (pp. 70-77). Mahwah, NJ: Erlbaum. Retrieved from http://www.umich.edu/~icls/proceedings/pdf/Stahl.pdf

Stern, H., Fung-Kee-Fung, M., Urbach, D., Smith, A., Brouwers, M., & Langer, B. (2007). *Sustainable improvement in quality indicators in Ontario's surgical oncology program (SOP).* Paper presented at the 2007 ASCO Annual Meeting Proceedings Part I. Vol 25, No. 18S (June 20 Supplement), 2007: 6638. Retrieved from: http://www.asco.org/ascov2/Meetings/Abstracts?&vmview=abst_detail_view&confID=47&abstractID=31088

Straus, S. E., & McAlister, F. A. (2000). Evidence-based medicine: a commentary on common criticisms. *CMAJ, 163*(7), 837-841. Retrieved from: http://www.cmaj.ca/content/163/7/837.full

Straus, S. E., Tetroe, J., & Graham, I. D. (2009). Knowledge to action: what it is and what it isn't. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 3-9). Hoboken: Blackwell Publishing Ltd.

Strom, K. (2006). The Hearing Review 2006 Dispenser Survey, *The Hearing Review*. Retrieved from http://www.hearingreview.com/issues/

Strom, K. (2009). CR shows us a great opportunity, *The Hearing Review*. Retrieved from http://www.hearingreview.com/issues/

Trivedi, M. H., Kern, J. K., Grannemann, B. D., Altshuler, K. Z. (2004). A computerized clinical decision support system as a means of implementing depression guidelines. *Psychiatric Services, 55*(8):879-885. Retrieved from: http://ps.psychiatryonline.org/cgi/reprint/55/8/879.pdf

Tsiakpini, L., Weichbold, V., Kuehn-Inacker, H., Coninx, F., D'Haese, P., & Almadin, S. (2004). LittlEARS® Auditory Questionnaire. Innsbruck, Austria: MED-EL.

Upshur, R. E., VanDenKerkhof, E. G., & Goel, V. (2001). Meaning and measurement: An inclusive model of evidence in health care. *Journal of Evaluation in Clinical Practice, 7*(2), 91-96. doi: 10.1046/j.1365-2753.2001.00279.x

Valente, M. C., Abrams, H., Benson, D., Chisholm, T., Citron, D., Hampton, D., … Sweetow, R. (2006). Guidelines for the audiologic management of adult hearing impairment. *Audiology Today, 18*(5). Retrieved from: http://www.audiology.org/resources/audiologytoday

Vernacchio, L., Vezina, R., Mitchell, A. (2006). Knowledge and practices relating to the 2004 acute otitis media clinical practice guideline: A survey of practicing physicians. *Pediatric Infectious Disease Journal, 25*(5), 385-389. doi: 10.1097/01.inf.0000214961.90326.d0

Westbrook, Braithwaite, J., Gibson, K., Paoloni, R., Callen, J. Georgiou, A., … Robertson, L. (2009). *BMC Health Services Research,* 9: 201. doi: 10.1186/1472-6963-9-201

Zipoli, R. P., Jr., & Kennedy, M. (2005). Evidence-based practice among speech-language pathologists: Attitudes, utilization, and barriers. *American Journal of Speech-Language Pathology, 14*(3), 208-220. doi:10.1044/1058-0360(2005/021)

Chapter 6

6 Summary of project results, contribution to the literature, implications, strengths and limitations, future work and concluding statements

6.1 Summary of project results

For more than 20 years, the profession of audiology has been working on incorporating evidence-based practice (EBP) principles into practice. Implementation of EBP is part of The Canadian Association of Speech-Language Pathologists and Audiologists (CASLPA) 2008 vision, mission and values statement and is included as a 'core value' by the American Academy of Audiology (AAA; AAA, n.d; CASLPA, n.d.). AAA defines EBP as "To practice according to best clinical practices for making decisions about the diagnosis, treatment, and management of persons with hearing and balance disorders, based on the integration of individual clinical expertise and best available research evidence." (AAA, n.d.).

Factors influencing the implementation of EBP have not been well studied among audiologists. The first paper included within this dissertation furthers our understanding of the factors that influence the use of EBP by Canadian audiologists. The majority of Canadian audiologists reported that they knew how to find research reports; understood the reports; felt confident in judging the quality of the research, and could identify the implications of research findings for their practice. Canadian audiologists reported that the greatest barriers to changing practice on the basis of 'best evidence' were insufficient time at work to find research and to implement any changes in practice.

Although not intended to replace professional judgment and training, clinical practice guidelines (CPGs) assist audiologists in implementing EBP by providing succinct recommendations that reduce practice variation, improve diagnostic accuracy, promote effective habilitation/rehabilitation treatment, and discourage ineffective, or potentially harmful treatment interventions (Chapter 3; Moodie, Kothari et al., 2011). Despite these advantages, research has shown that CPGs will not be implemented into clinical practice

just because they make sense and meet specified needs (Graham et al., 2006; Harrison, Graham, & Fervers, 2009; Harrison, Légaré, Graham, & Fervers, 2010). For example, recent studies indicate that approximately 30% of children living with hearing impairment are not receiving audiological services consistent with CPG recommendations (Lindley, 2006; Moodie, Rall et al., 2011).

Analyses of the barriers that exist in implementing EBP indicate that obstacles could exist at multiple levels including: (a) at the level of the guideline; (b), the individual practitioner; (c), the context in which healthcare practitioners work; (d), the wider practice environment; and (e) at the level of the patient (Damschroder et al., 2009; Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003; Fixsen, Naoom, Blase, Friedman, & Wallace, 2005; Francke, Smit, de Veer, & Mistiaen, 2008; Glasgow & Emmons, 2007; Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004; Grol & Grimshaw, 2003; Grol, Bosch, Hulscher, Eccles, & Wensing, 2007; Légaré, 2009; McCormack et al., 2002; Moodie, Kothari et al., 2011; Rycroft-Malone, 2004). A discussion of these influential factors is included throughout this PhD dissertation and they are summarized in Appendix A. The factors reveal the complex processes involved in diffusion of knowledge and clinical practice behaviour change and provides us with a better understanding of why there is a knowledge-to-action (KTA) gap. The complexity may be reduced with early, proactive and targeted involvement of researchers, practitioners, policy-makers and patients (i.e., the knowledge users) in the development and dissemination of evidence for clinical practice (Graham et al., 2006; Harrison et al., 2010; Innvaer, Vist, Trommald, & Oxman, 2002; Landry, Amara, & Lamari, 2001; Lomas, 2000; McWilliam et al., 2009; Roux, Rogers, Biggs, Ashton, & Sergeant, 2006; Straus, 2009).

Research has shown that healthcare practitioners want their knowledge, perceptions and beliefs heard, acknowledged and implemented as part of the CPG development process (Browman & Brouwers, 2009; Browman, Makarski, Robinson, & Brouwers, 2005; Evans, Graham, Cameron, Mackay, & Brouwers, 2006; Fung-Kee-Fung et al., 2009; Stern et al., 2007). By doing this 'up front' (prior to a dissemination and/or implementation phase and during the CPG development process) we have the potential to

overcome the barriers to implementation and to produce more than the small to moderate implementation effects currently reported in the CPG uptake literature (Eccles et al., 2009; Hakkennes & Dodd, 2008; McCormack et al., 2002; Rycroft-Malone, 2004; Rycroft-Malone et al., 2004; Rycroft-Malone et al., 2002; Wensing, Bosch, & Grol, 2009). In addition we have the opportunity to increase longer term adherence to the CPG, ultimately affecting patient outcomes and quality of provided care.

The overall goals for this dissertation project were: to develop an improved understanding of the important factors that influence implementation of evidence-based practice by Canadian audiologists; and to utilize the knowledge-to-action process (Graham et al., 2006) during the development of a guideline for outcome measures to evaluate the auditory development and performance of young children who wear hearing aids, to facilitate clinical uptake and identify barriers to implementation (Bagatto, Moodie & Scollie, 2010; Bagatto, Moodie, Malandrino et al., 2011; Bagatto, Moodie, Seewald, Bartlett, & Scollie, 2011; Moodie, Bagatto et al., 2011; Moodie, Kothari et al., 2011).

The results of the evidence-based practice study of Canadian audiologists presented in Chapter 2 demonstrate that Canadian audiologists possess the skills and expertise to be active participants in the knowledge creation process. As such, we felt, that they presented a community of practice (CoP) that could assist with reducing the knowledge-to-action gaps in pediatric audiology outcome measures, assist with knowledge diffusion and be facilitators of practice change. As researchers we felt we had the expertise to develop evidence-based measures, but clinicians would be better able to "…provide a road map to the potential mine fields inherent in attempting to introduce change in any organization" (Graham & Tetroe, 2009, para. 11). The fundamental and inter-related elements of CoPs are: domain, community and practice. In this project, the *domain* focus was on developing a CPG to evaluate the auditory development and performance of young children with permanent childhood hearing impairment (PCHI) who wear hearing aids. The *community* of pediatric audiologists we collaborated with, whom we refer to as The Network of Pediatric Audiologists of Canada, collectively cared about developing a high-quality, clinically feasible and useful practice guideline and expressed a desire to

create, share and use their *practice* expertise and experiences to optimize the creation and dissemination of the CPG.

The development of outcome measures to evaluate the auditory development and performance of young children who wear hearing aids was an agreed upon research objective between the audiologists and the researchers (Chapter 3; Moodie, Kothari et al., 2011). This decision was made, in part, because the outcome evaluation stage of the hearing aid fitting process within current guidelines lacks evidential, well-validated methods for appraising the auditory development and performance of young children fitted with hearing aids (Bagatto, Moodie, Seewald et al., 2011). This gap in evidence-based outcome measurement tools was reported by Canadian pediatric audiologists as a barrier to providing high-quality and effective services to children and their families (Chapter 3; Moodie, Kothari et al., 2011).

The framework chosen to guide this project was the knowledge-to-action process described by Graham and colleagues (Graham et al., 2006; Graham & Tetroe, 2007; Harrison et al., 2010; Straus, Tetroe, & Graham, 2009). The visual representation of the framework is shown in Figure 3-1. It is described in detail in Chapter 3 of this dissertation and is published as Moodie, Kothari et al., 2011. The KTA process suggests that knowledge products, such as CPGs, that are created to address identified problems/gaps in clinical practice, are best developed utilizing a dynamic and iterative process that synthesizes and tailors the end product for clinical use. The 'tailoring' of the knowledge product not only includes attention to appropriate inclusion and summarization of the research evidence, it also identifies, through active collaboration with important stakeholders (such as a CoP), activities that should be considered to guide the application of the knowledge in clinical practice. These implementation components include: identification of a problem that needs addressing; and identification, review and selection of knowledge relevant to addressing the problem; adaptations for use in local contexts; assessment of the barriers and facilitators to the use of the knowledge; selecting, tailoring and implementing interventions to ease and promote knowledge use; monitoring the use of knowledge; evaluation of functional and process outcomes of using the knowledge and development of methods to sustain ongoing knowledge use.

Chapter 4 of this dissertation (published as Moodie, Bagatto et al., 2011) described the first stage of this integrated KT project. Our objective in this work was to use the KTA framework (Graham et al., 2006; Graham & Tetroe, 2007; Harrison et al., 2010; Straus et al., 2009) as a guide to collaboratively partner with audiologists to: (1) develop an implementable CPG to measure auditory development and performance of young children with PCHI who wear hearing aids; and (2) develop an appropriate understanding of barriers to implementation and facilitators that might positively impact use of the desired knowledge in clinical practice.

We asked several questions in our initial questionnaire to determine what pediatric audiologists in Canada were currently doing in practice to measure auditory development and performance of young children wearing hearing aids. Results indicated that there appeared to be no consistent battery of outcome evaluation tools currently being used. When queried, numerous measures were listed as possible measures that were being used (Chapter 4; Moodie, Bagatto et al., 2011), however they were most often being conducted by other professionals (e.g., speech-language pathologists) and were most appropriate for children six years of age or older (Bagatto, Moodie, Seewald et al., 2011).

Using the KTA process as a guide, we carefully selected and synthesized the available evidence on measuring pediatric auditory development and performance of young children fitted with hearing aids (Bagatto, Moodie, Seewald et al., 2011), and developed an initial draft of recommendations for clinical practice. We took several initial outcome measurement tools to the The Network of Pediatric Audiologists of Canada to gather information relative to their perceptions of each of the measurement tools, and its use in the contexts in which they worked; and to develop an appropriate understanding of barriers and facilitators that could be used for translating the desired knowledge into action in clinical practice. One of the advantages to collaboratively working on this project with audiologists in clinical practice was that we were able to obtain substantial feedback from them to assist with decisions on what to include based not only on evidence, but also on the experiential judgment of clinicians, and the comments expressed to them by the parents of the children in their care. As described in Chapter 4 (Moodie, Bagatto et al., 2011), there were two versions of the PEACH outcome measure

being considered for inclusion in the final CPG. If we had relied solely on choosing outcome measures that were based on the highest level of grades for evidence, then as researchers, we may have selected the PEACH Diary for inclusion. Overall the PEACH Diary received a very good grade on our critical review of the evidence (Bagatto, Moodie, Seewald et al., 2011). However, the interview-style format introduced several concerns. We had also reviewed a version of the PEACH that was not interview style (PEACH Rating Scale; Ching & Hill, 2005b). It scored lower than the diary in our evidential critical review. The PEACH Rating Scale asks parents to retrospectively (during the prior week) rate the presence/absence of auditory related behaviors. We took both tools to the Network audiologists to ascertain their opinions. We were informed that, regardless of the organizational setting, and/or province in which they worked, the audiologists found the version of the PEACH that used the rating scale to be a more clinically feasible outcome evaluation tool to include in the guideline. Audiologists indicated that the PEACH rating scale was less difficult to score and interpret, less time consuming for parents and audiologists, would have more support and acceptance for use in their workplace setting, would require less development of new skills and knowledge to be able to use, and was more practical to implement than the PEACH diary. More audiologists indicated that they were more likely to use the PEACH rating scale in daily practice if it became part of the guideline. So, despite the fact that the PEACH diary had a stronger evidential base, knowledge users indicated that the PEACH rating scale was more likely to be used in practice.

The application cycle of the KTA framework outlines the activities that may be needed for the uptake of knowledge in clinical practice (Graham et al., 2006; Graham & Tetroe, 2007; Harrison et al., 2009; Harrison et al., 2010; Straus, 2009; Straus et al., 2009). The initial stages in the application cycle are the identification of a clinical problem that needs addressing, and identification, review and selection of appropriate knowledge/research that is relevant to the problem; adaptation of the evidence/knowledge/research to the local context; and identification of barriers/facilitators to knowledge use. During the initial evaluation of the considered guideline components, the Network audiologists did suggest revisions, modifications and/or additions to the measures prior to their final inclusion in a guideline. These included:

- translation into languages appropriate for the large, urban, multi-cultural environments in which they work;
- produce materials at a grade four reading level;
- development of a clinical summary form;
- darkening of lines and shaded regions on score sheets to make visualization easier;
- development of a percentage score look-up table for the PEACH so that audiologists would not have to find a calculator to determine percentage score;
- development of a PEACH rating scale score sheet so that performance ranges are clearly visible and individual scores can be interpreted; and
- the ability for audiologists to put the PEACH rating scale scores for multiple appointments on one sheet, to assist with tracking changes over time.

In terms of barriers to clinical implementation, the Network audiologists were concerned that parents might not take the time to perform the outcome measurement tasks required of them. Network audiologists who tried to implement the initial guideline components in practice indicated that on average it would take them about 15 minutes of extra appointment time to administer. They were concerned that they would run into appointment time issues, especially while they were gaining confidence and learning how to administer/interpret the outcome measures. An additional barrier noted to clinical implementation of the LittlEARS Auditory Questionnaire (Tsiakpini et al., 2004; Copyright MED-EL, 2004); is that it is copyrighted material. Copies must be purchased directly from the Med-El Medical Electronics Co. (www.medel.com) and daily clinical use could become expensive.

Some suggestions for training materials were recommended by the audiologists, including case examples and 'frequently-asked-questions' sections for the guideline binder and the development of a training video to accompany the documentation.

After evaluating the individual components being considered as part of the guideline, approximately 90% of the Network audiologists indicated that they were moderately to very likely to implement the measures in their daily practice. This contributed to the objective of developing a guideline that would produce more than the small to moderate

implementation effects currently reported in the CPG uptake literature (Eccles et al., 2009; Hakkennes & Dodd, 2008; McCormack et al., 2002; Rycroft-Malone, 2004; Rycroft-Malone et al., 2004; Rycroft-Malone et al., 2002; Wensing et al., 2009).

However, regardless of the availability of resources, the ability for the pediatric audiologists to change practice if they chose to, the expertise and knowledge of the audiologists, the good leadership, and the culture and institutional support in the contexts in which they work, approximately ten percent of the Network audiologists indicated that they would not likely implement the evaluation tools in their daily practice. We asked the audiologists to provide reasons if they selected 'not likely' as their response. Overall, subjectively, it appears that relative advantage or utility/comparative value were primary reasons why they might not implement the outcome evaluation tools in daily practice. Relative advantage or comparative value relates to the new measure(s) that are part of the guideline being better than existing or alternative methods (Rogers, 2005). Audiologists who selected 'not likely" as their response to daily use, reported that much of the information obtained by the use of the CPG would generally be covered by routine questions asked during the course of most appointments so "adding the tool perhaps did not add value." They also reported that "asking the same questions every time, the same way, does not necessarily uncover other issues that need to be addressed / worked on."

In an effort to reduce barriers to implementation, the research team reviewed all of the information provided by the Network audiologists and made revisions to the materials where possible, including for example: revision to scoring sheets, newly developed training materials (including training DVD/CD), development of translated materials into requested languages, and administration guideline flowcharts. The final version of the guideline has been released as The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) version 1.0 (Bagatto, Moodie, Malandrino et al., 2011; Bagatto, Moodie & Scollie, 2010).

Chapter 5 of this dissertation presented the results of the evaluation of the released version of the UWO PedAMP by The Network of Pediatric Audiologists of Canada.

The UWO PedAMP v1.0 is comprised of the following tools:

1. Aided Speech Intelligibility Index (SII) Normative Values Worksheet;
2. Hearing Aid Fitting Summary;
3. LittlEARS Auditory Questionnaire (Tsiakpini et al., 2004; Copyright MED-EL, 2004);
4. Parents' Evaluation of Aural/Oral Performance of Children Rating Scale (PEACH; Ching & Hill, 2005a, b; Copyright Australian Hearing, 2005).

The Aided Speech Intelligibility Index (SII) Normative Values Worksheet and the Hearing aid Fitting Summary provide important pre-functional outcome measures of the hearing aid fitting process. That is, they provide information about the quality of the hearing aid fitting process, as well as information about audibility of aided speech received by the child wearing hearing aids. The LittlEARS and the PEACH measure functional outcomes. All are important components to the UWO PedAMP. Additional information on these measures and their clinical application can be found in Bagatto et al., 2010; Bagatto, Moodie, Malandrino et al., 2011; Bagatto, Moodie, Seewald et al., 2011.

Results of the evaluation of the UWO PedAMP version 1.0 by The Network of Pediatric Audiologists of Canada (presented in Chapter 5) generally indicated that they believe it to be a high-quality, systematic, hearing aid outcome evaluation tool that improves the quality and effectiveness of audiological care received by young children with hearing loss and their families. The majority of respondents ($\geq$ 79%) reported that the length of time it would take to administer, score, interpret results and counsel parents was appropriate for incorporation of the UWO PedAMP into routine clinical practice. Interpretation of test results was facilitated by the normative data in the documentation provided, and assisted parents and audiologists in decision-making. Eighty-six percent of respondents indicated that the UWO PedAMP v1.0 should be implemented as part of preferred audiology practice. All (100%) of the pediatric audiologists indicated that they were moderately to very likely to use the UWO PedAMP in daily practice.

Approximately 80% of audiologists indicated that they were very likely to use the final released version of the UWO PedAMP on a daily basis, which represents an improvement over the results obtained during the initial evaluation of the guideline components. This improvement could be attributed to the alterations and additions made based on the initial evaluation results. The majority of the Network audiologists (≥ 92%) believed that their participation in this project increased the impact that the UWO PedAMP would have in clinical practice compared to what it would have been if researchers had developed it without their input. The same percentage reported that in their opinion this partnership increased the potential for clinical uptake of the UWO PedAMP.

Despite widespread support for the UWO PedAMP v1.0, the Network audiologists provided multiple suggestions for revisions. Two of the most important concerned: reducing the frequency of test administration; and continued evaluation of the PEACH to determine its effectiveness as an outcome measurement tool, especially when used with children having multiple medical conditions. Audiologists believe that future versions of the UWO PedAMP would benefit by including additional interpretative information based on test scores on the LittlEARS and the PEACH for audiologists and parents. Audiologists would also like to see the UWO PedAMP include tools (e.g. objective speech measures) for continued evaluation for children older than six years of age. A computer-assisted implementation of the UWO PedAMP is seen as an avenue to facilitate not only clinical uptake, but electronic sharing of data, and the development of a database of difficult cases for audiologist learning and training experiences.

6.2 Overall contribution to the literature

The projects described throughout this dissertation contribute to the audiology sciences literature in the following ways:

1. Chapter 2 improves our understanding of the factors that influence the use of EBP by Canadian audiologists;

2. Chapter 3 provides a detailed description of how knowledge translation and communities of practice could reduce the complexity associated with moving evidence into audiology practice. This may be the first paper published in audiology on these topics (Moodie, Kothari et al., 2011).
3. Chapters 4 and 5 provide evidence that use of the dynamic and iterative knowledge-to-action framework (Graham et al., 2006) during the creation of knowledge products, such as a clinical practice guideline, may improve the tailored end-product in such a way that it is acceptable to practitioners and adopted into clinical practice;
4. The active and ongoing participation of The Network of Pediatric Audiologists of Canada emphasizes the potential for a strong CoP in pediatric audiology in Canada that could continue to partner with researchers and be used as knowledge brokers.

The projects described throughout this dissertation contribute to the knowledge translation literature in the following ways:

1. Chapter 2 provides evidence that Canadian audiologists possess the skills and expertise to be active participants in the knowledge translation process;

2. Chapters 4 and 5 provide evidence that use of a collaborative, dynamic and iterative approach that attends to important factors related to the creation **and** application of knowledge during the development process may result in substantial improvements to the: quality, feasibility, utility, acceptability, interpretability and clarity of the final knowledge product.

3. By partnering with audiologists in practice we were able to document important information about the characteristics of the: guideline; audiologist; context in which they worked; and the families that they provide services to, that could be barriers or facilitators to the use of the guideline in practice. We were able to use this information to address concerns *during* the development process, ultimately improving the implementability of the guideline when officially released for wide-spread use.

4. Chapters 4 and 5 provide evidence that, at least in the profession of audiology, clinicians want their knowledge, perceptions and beliefs heard, acknowledged and implemented as part of the CPG development process. By doing this during the guideline creation process we were able to demonstrate that this resulted in 80% of the Network audiologists stating that they were very likely to make use of the UWO PedAMP in daily practice.

5. Chapters 4 and 5 provide evidence that despite the time challenges, audiologists value research partnership opportunities, especially when it provides them with an opportunity to improve a measurement tool that will be put into clinical use.

6.3 Implications

Several implications can be inferred from this work for the profession of audiology in general, and for audiology in Canada more specifically.

Canadian audiologists who participated in our evidence-based practice survey, understand the importance of, and possess the knowledge and skills, to implement evidence into their clinical practice. Results of this work indicate that they want to select which outcome evaluation tools to use in clinical practice based on the best available evidence. They also wish to integrate and balance information based on evidence with their clinical experience and by valuing their young patients and their families as individuals.

The KTA framework utilized throughout this project views the creation of knowledge as a collaborative and iterative engagement process. Accordingly, evidence and expertise are reflected upon to create a tailored product that will have the potential to overcome barriers to implementation and will ultimately affect patient outcomes and quality of provided care. The implications of this approach for pediatric audiology are that it requires active participation by researchers and audiologists throughout the knowledge creation and application processes. The results of this body of work indicate that use of this dynamic and iterative approach led to, in the opinion of the Network participants, the development of a high-quality, systematic, hearing aid outcome evaluation tool that will

be used in daily clinical practice, and will improve audiological care received by young children with hearing loss and their families.

The development of a CoP in audiology, especially in pediatric audiology, could provide an avenue for ongoing collaborative partnership between researchers and audiologists. The development of The Network of Pediatric Audiologists of Canada as part of this project provided an opportunity to obtain input from audiologists across a large geographical area, including rural and urban audiologists, and experienced and novice clinicians. The implications of this innovative approach is that the UWO PedAMP is viewed by the Network audiologists as having increased clinical impact and potential for uptake than if the research team had developed it without their input. All members of The Network of Pediatric Audiologists of Canada reported that, despite the time challenges, they would work again in this partnership to create new knowledge or to undertake other research studies. Implications of this project indicate that an ongoing CoP in audiology could play an important role in: creation of knowledge products, including CPGs; participation in data collection and 'norming' of clinical tools (see Bagatto, Moodie, Malandrino et al., 2011); identification of barriers to implementation of new knowledge; translation of knowledge into clinical practice; development of practice leaders; provision of input on difficult clinical cases; the development of case examples for training materials; sharing of information, reduction in professional isolation (important for rural clinicians) and facilitating practice implementation and change.

The incidence rate of permanent childhood hearing impairment of reportedly 1-3/1,000 births (Hyde, 2005) can make obtaining sufficient sample sizes for projects difficult at one site, or even in one city. The Network of Pediatric Audiologists of Canada provides us with an opportunity to: (a) design and conduct studies on childhood hearing impairment with increased sample size relative to many currently published studies; (b) complete studies in a more timely manner than is currently possible, due to recruitment challenges; and (c) have access to a diverse sample of children with PCHI for study inclusion.

6.4 Strengths and limitations

This project expanded the knowledge we have in audiology about the factors that influence the use of evidence in practice and improve our understanding of why there is a knowledge-to-clinical-action gap. It provided evidence that the use of appropriate knowledge creation and translation strategies could facilitate the development of CPGs that will be used in daily clinical practice. It increased our understanding of the potential barriers to practice change and facilitators that need to be in place to move evidence into practice at individual, organizational, guideline, patient and broader health care levels. It also provided evidence that pediatric audiology in Canada could benefit from the ongoing development of a CoP approach.

This project is not without limitations. The initial sites for The Network of Pediatric Audiologists of Canada were purposefully selected as they had self-identified as sites that were interested in participating in research. It should be noted however, that although the *sites* self-identified, the managers at the sites chose the audiologists they wished to have participate. They selected novice to experienced audiologists. It is also interesting to note that since we have published and presented the results of this work at conferences we have been approached by numerous other audiologists across Canada to join the Network. We have also been requested to expand membership to other countries (e.g., The United States) as well.

Audiologists in Canada may have more training in evidence-based practice than other countries. They may have more access to appropriate equipment in their practices, more supportive work environments and may be able to interact with experts in the area of pediatric audiology more than other countries can. Therefore, results of this project may not generalize to other countries.

With the exception of the DEBP questionnaire (Gerrish et al., 2007) used in Chapter 2, the questionnaires used throughout this project were developed for the purposes of this project and were not validated instruments and may have not included items of importance. We did however attempt to include constructs of relevancy to the KT

literature including items associated with: quality, feasibility, clinical value, applicability, clarity, interpretability, barriers and facilitators to implementation, recommendations for revisions, modifications and additions. We hoped to reduce some of the limitations in the objective measurement tools by providing audiologists with comment sections at the end of each item. The audiologists provided in-depth written comments that augmented our understanding of the study results.

There are some potential limitations in using an integrated knowledge translation approach to knowledge development. These include the potential for increased cost and time for guideline development, and difficulty obtaining release-from-practice time for audiologists to participate in the guideline development process without financial reimbursement to their employer. Additionally, it may be difficult to reach consensus between partners on what constitutes an acceptable modification to a guideline.

As indicated by Li and colleagues, bringing together professionals and calling them a CoP does not mean that they actually are one (Li et al., 2009). CoPs are defined as "groups of people who share a concern, set of problems or enthusiasm about a topic, and who deepen their knowledge and expertise about a topic by interacting on an ongoing basis" (Barwick et al., 2005; Barwick, Peters, & Boydell, 2009; Li et al., 2009; Moodie et al., 2011; Wenger, McDermott, & Snyder, 2002). One of the goals of this work was to develop the Network of Pediatric Audiologists of Canada into a CoP. Although the Network currently meets the criteria of a CoP from the domain, community and shared practice perspective, there is currently no structure (physical or internet-based) that enables them to interact *directly with each other* to share information. This is an important component to CoPs and may be very important when you have a CoP that is distributed across a wide geographical area (Friberger & Falkman, 2011). Attempts were made during the initial stages of this work to put an electronic meeting and 'chat' mechanism in place, but this was hindered by lack of professional expertise and their availability, time, and a general lack of understanding of what effort would be required to develop and maintain such a site. Continued grant applications will be submitted to try to obtain appropriate funding to meet face-to-face, plan future work, train audiologists who

were not part of the Network on the use of the UWO PedAMP, and develop strategies to enable a successful CoP to be developed.

Finally, use of the UWO PedAMP is being mandated for use by audiologists within the Ontario Infant Hearing Program (OIHP). Ontario-based audiologists who participated in this project knew that this outcomes battery would have to be implemented within their practice; therefore this awareness could have impacted their ratings of the measures and their written input. An examination of results indicates that all of the audiologists, regardless of the fact some would be mandated to use the measures, wanted their knowledge, experience, perceptions and beliefs heard and acknowledged as part of the UWO PedAMP development process. They knew and appreciated that they had an opportunity to tailor the UWO PedAMP for use in clinical practice.

6.5 Future work

The profession of audiology will benefit from the science of knowledge translation and implementation research. Results of this body of work lead naturally to potential future projects including:

1. continued efforts to provide appropriate training opportunities for students and practicing audiologists to develop the appropriate skills for the development and implementation of evidence-based practice;
2. investigation and identification of factors influencing ‘busyness’ in the context of audiology practice (Thompson et al., 2008);
3. examination of strategies that might change organizational behaviour to value and facilitate audiologists access to evidence and time during the work day to read and plan for implementation in practice;
4. improvement of our understanding of how individual and contextual/environmental (institutional, cultural, physical, social) factors influence knowledge translation in clinical audiology practice. This could develop contextually appropriate strategies for facilitating EBP across audiology practice environments;

5. evaluation of the UWO PedAMP v1.0 and related training materials by audiologists who are not members of the Network of Pediatric Audiologists of Canada, and who practice in other countries;
6. closer examination of current project results to determine which implementation interventions might be used to facilitate practice behaviour change (Michie et al., 2011) at individual and organizational levels for use of the UWO PedAMP;
7. monitoring the use of the UWO PedAMP v1.0 in current implemented settings;
8. measurement of outcomes (at program and family level) of use of the UWO PedAMP in clinical practice settings;
9. continued partnering with the Network of Pediatric Audiologists of Canada to improve the UWO PedAMP for future versions;
10. continued development, and possible expansion, of the Network of Pediatric Audiologists of Canada as a CoP to facilitate the continued creation and application of knowledge in pediatric audiology.

6.6 Concluding statements

The results presented in this body of work generally agree with the existing KT literature that indicates that utilization of a collaborative and integrated KT approach to the creation of knowledge will result in a product that will have the potential to reduce barriers to implementation and facilitate the movement of evidence into practice (Browman & Brouwers, 2009; Browman et al., 2005; Evans et al., 2006; Stern et al., 2007). Using the KTA framework of Graham and colleagues (2006) we collaborated with The Network of Pediatric Audiologists of Canada to produce a CPG to evaluate the auditory development and performance of children with permanent childhood hearing impairment (PCHI) who wear hearing aids and are aged birth to six years that would be recommended for implementation in practice. The UWO PedAMP version 1.0 is considered by the Network respondents to be a high-quality, systematic, hearing aid outcome evaluation tool that improves the quality and effectiveness of audiological care received by young children with hearing loss and their families. The length of time it would take to administer, score, interpret results and counsel parents was considered appropriate for incorporation of the CPG into routine clinical practice. Interpretation of

test results was facilitated by the normative data in the documentation provided, and assisted parents and audiologists in decision-making. Eighty-six percent of audiologists in the Network indicated that the UWO PedAMP v1.0 should be implemented as part of preferred audiology practice. Approximately 80% of audiologists indicated that they were very likely to use the final released version of the UWO PedAMP on a daily basis, which represents an improvement over the results obtained during the initial evaluation of the guideline components. This may indicate that changes made by the research team after receiving feedback from the Network audiologists reduced potential barriers to implementation. This collaborative work is viewed by clinicians as having increased clinical impact and potential for uptake than if the research team had developed the UWO PedAMP without their input. Despite the time challenges and commitments projects like this entail, all members of The Network of Pediatric Audiologists of Canada reported that they would work again as a collaborative to create new knowledge or to undertake other research studies.

6.7 References

American Academy of Audiology. *Core Values Statement*. Retrieved from: http://www.audiology.org/about/information/Documents/CoreValuesModel.pdf

Bagatto, M.P., Brown, C.L., Moodie, S.T., & Scollie, S.D. (2011) External validation of the LittlEARS® Auditory Questionnaire with English-speaking families of Canadian children with normal hearing, *International Journal of Pediatric Otorhinolaryngology*, 75(6), 815-817.

Bagatto, M. P., Moodie, S. T., Malandrino, A. C., Richert, F. M., Clench, D. A., & Scollie, S. D. (2011). The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP). *Trends in Amplification, 15*(1), 57-76. doi: 10.1177/1084713811420304

Bagatto, M. P., Moodie, S. T., & Scollie, S. D. (2010). *The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP): Version 1.0.* Child Amplification Laboratory, University of Western Ontario: London, ON.

Bagatto, M. P., Moodie, S. T., Seewald, R. C., Bartlett, D. J., & Scollie, S. D. (2011). A critical review of audiological outcome measures for infants and children. *Trends in Amplification, 15*(1), 23-33. doi: 10.1177/1084713811412056

Barwick, M. A., Boydell, K. M., Stasiulis, E., Ferguson, H. B., Blase, K., & Fixsen, D. (2005). Knowledge transfer and evidence-based practice in children's mental health. Toronto, ON: Children's Mental Health Ontario. Retrieved from: http://www.kidsmentalhealth.ca/documents/KT_exec_summary.pdf

Barwick, M., Peters, J., & Boydell, K. (2009). Getting to uptake: Do communities of practice support the implementation of evidence-based practice. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 18*(1), 16-29.

Bess, F. (2000). Early Amplification for Children: Implementing Change. In R. C. Seewald (Ed.), *A Sound Foundation Through Early Amplification: Proceedings of an International Conference* (pp. 247.251). Staffa, Switzerland: Phonak AG.

Browman, G. P., & Brouwers, M. (2009). The role of guidelines in quality improvement for cancer surgery. *Journal of Surgical Oncology, 99*(8), 467-469. doi: 10.1002/jso.21171.

Browman, G. P., Makarski, J., Robinson, P., & Brouwers, M. (2005). Practitioners as experts: The influence of practicing oncologists "in-the-field" on evidence-based guideline development. *Journal of Clinical Oncology, 23*(1), 113-119. doi: 10.1200/JCO.2005.06.179.

Canadian Association of Speech-Language Pathologists & Audiologists (n.d.). *CASLPA Vision, Mission & Values*. Retrieved from: http://www.caslpa.ca/PDF/Mission_vision%20_values_2008_english.pdf

Ching, T. Y., & Hill, M. (2005a). The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Diary. Chatswood, New South Wales, Australia: Australian Hearing. Retrieved from: http://www.outcomes.nal.gov.au/Assesments%20&%20Resources/PEACH%20Final%20April%2006%20_foldable_.pdf.

Ching, T. Y., & Hill, M. (2005b). The Parents' Evaluation of Aural/Oral Performance of Children (PEACH) Rating Scale. Chatswood, New South Wales, Australia: Australian Hearing. Retrieved from: http://www.outcomes.nal.gov.au/LOCHI%20assessments.html

Damschroder, L., Aron, D., Keith, R., Kirsh, S., Alexander, J., & Lowery, J. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science, 4*(1):50. doi:10.1186/1748-5908-4-50

Eccles, M., Armstrong, D., Baker, R., Cleary, K., Davies, H., Davies, S., … Sibbald, B. (2009). An implementation research agenda. *Implementation Science, 4*:18. doi: 10.1186/1748-5908-4-18

Estabrooks, C. A., Floyd, J. A., Scott-Findlay, S., O'Leary, K. A., & Gushta, M. (2003). Individual determinants of research utilization: A systematic review. *Journal of Advanced Nursing, 43*(5), 506-520. doi: 10.1046/j.1365-2648.2003.02748.x

Evans, W. K., Graham, I. D., Cameron, D., Mackay, J. A., & Brouwers, M. (2006). Practitioner feedback on lung cancer practice guidelines in Ontario. *Journal of Thoracic Oncology, 1*(1), 10-18.

Fixsen, D., Naoom, S. F., Blase, K. A., Friedman, R. M., & Wallace, F. (2005). *Implementation Research: A synthesis of the literature*. Tampa, FL: University of South Florida, Louis de la Parte Florida Mental Health Institute, The National Implementation Research Network (FMHI Publication #231). Retrieved from: http://ctndisseminationlibrary.org/PDF/nirnmonograph.pdf

Francke, A. L., Smit, M. C., de Veer, A. J. E., & Mistiaen, P. (2008). Factors influencing the implementation of clinical guidelines for health care professionals: A systematic meta-review. *BMC Medical Informatics and Decision Making*, 2008, 8, 38. doi:10.1186/1472-6947-8-38

Friberger, M. G., Falkman, G. (2011). Collaboration processes, outcomes, challenges and enablers of distributed clinical communities of practice. *Behaviour & Information Technology*. doi: 10.1080/0144929X.2011.602426

Fung-Kee-Fung, M., Watters, J., Crossley, C., Goubanova, E., Abdulla, A., Stern, H., & Oliver, T. K. (2009). Regional collaborations as a tool for quality improvements in surgery: A systematic review of the literature. *Annals of Surgery, 249*(4), 565-572 510.1097/SLA.1090b1013e31819ec31608.

Gerrish, K., Ashworth, P., Lacey, A., Bailey, J., Cooke, J., Kendall, S., …McNeilly, E. (2007). Factors influencing the development of evidence-based practice: a research tool. *Journal of Advanced Nursing, 57*(3), 328-338. doi:10.1111/j.1365-2648.2006.04112.x

Glasgow, R., & Emmons, K. (2007). How can we increase translation of research into practice? Types of evidence needed. *Annual Review of Public Health, 28*, 413-433. doi:10.1146/annurev.publhealth.28.021406.144145

Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map? *The Journal of Continuing Education in the Health Professions, 26*, 13-24. Retrieved from: http://www.jcehp.com/vol26/2601graham2006.pdf

Graham, I. D., & Tetroe, J. (2007). How to translate health research knowledge into effective health care action. *Healthcare Quarterly, 10*(3), 20-22.

Graham, I., & Tetroe, J. (2009). Learning from the U.S. Department of Veterans Affairs quality enhancement research initiative: QUERI series. *Implementation Science.* Retrieved 05/05/2010 from: http://www.implementationscience.com/content/4/1/13.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Quarterly, 82*(4), 581-629. Retrieved from http://www.milbank.org/

Grol, R., & Grimshaw, J. (2003). From best evidence to best practice: effective implementation of change in patients' care. *Lancet, 362*, 1225-1230. doi:10.1016/S0140-6736(03)14546-1

Grol, R. P. T. M., Bosch, M. C., Hulscher, M. E. J. L., Eccles, M., & Wensing, M. (2007). Planning and studying improvement in patient care: The use of theoretical perspectives. *Milbank Quarterly, 85*(1), 93-138. Retrieved from http://www.milbank.org/

Hakkennes, S., & Dodd, K. (2008). Guideline implementation in allied health professions: A systematic review of the literature. *Quality & Safety in Health Care, 17*(4), 296-300.

Harrison, M. B., Graham, I. D, & Fervers B. (2009). Adapting knowledge to a local context. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 73-82). Hoboken NJ: Blackwell Publishing Ltd.

Harrison, M. B., Légaré, F., Graham, I. D., & Fervers, B. (2010). Adapting clinical practice guidelines to local contexts and assessing barriers to their use. *CMAJ, 182*(2), E78-E84.

Hyde, M.L. (2005). Newborn hearing screening programs: Overview. *Journal of Otolaryngology, 34* (S2), S70-S78. Retrieved from: http://www.mountsinai.on.ca/care/infant-hearing-program/documents/hydearticle.pdf

Innvaer, S., Vist, G. E., Trommald, M., & Oxman, A. D. (2002). Health policy-makers' perceptions of their use of evidence: A systematic review. *Journal of Health Services Research & Policy, 7*, 239-244.

Landry, R. N., Amara, N., & Lamari, M. (2001). Utilization of social science research knowledge in Canada. *Research Policy, 30*(2), 333-349.

Légaré, F. (2009). Assessing barriers and facilitators to knowledge use. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 83-93). Hoboken: Blackwell Publishing Ltd.

Li, L. C., Grmishaw, J. M., Nielsen, C., Judd, M., Coyte, P. C., & Graham, I. D. (2009). Evolution of Wenger's concept of community of practice, *Implementation Science*, 4:11, Retrieved December 10, 2010 from http://www.implementationscience.com/content/4/1/11.

Lindley, G. (2006). Current hearing aid fitting protocols: Results from an on-line survey. *Audiology Today, 18*(3), 19-22. Retrieved from http://www.audiology.org/resources/audiologytoday/

Lomas, J. (2000). Connecting research and policy. *ISUMA: Canadian Journal of Policy Research, 1*(1), 140-144.

McCormack, B., Kitson, A., Harvey, G., Rycroft-Malone, J., Titchen, A., & Seers, K. (2002). Getting evidence into practice: The meaning of context. *Journal of Advanced Nursing, 2002*(38), 94-104. doi:10.1046/j.1365-2648.2002.02150.x

McWilliam, C., Kothari, A., Ward-Griffin, C., Forbes, D., Leipert, B., & South West Community Care Access Centre Home Care, C. (2009). Evolving the theory and praxis of knowledge translation through social interaction: a social phenomenological study. *Implementation Science, 4*(1), 26.

Moodie, S. T., Bagatto, M. P., Miller, L. T., Kothari, A., Seewald, R. C., & Scollie, S. D. (2011). An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of the University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). *Trends in Amplification.15*(1),34-56. doi: 10.1177/1084713811417634

Moodie, S. T. F., Kothari, A., Bagatto, M. P., Seewald, R. C., Miller, L. T., & Scollie, S. D. (2011). Knowledge translation in audiology: Promoting the clinical application of best evidence. *Trends in Amplification, 15*(1), 5-22. doi: 10.1177/1084713811420740

Moodie, S., Rall, E., Lindley, G., Eiten, L., Davidson L., Littman, T., & Gordey, D. *Survey of Best Practices: Pediatric Hearing Aid Fitting.* Learning module presentation at The American Academy of Audiology: AudiologyNOW! Conference, Chicago, IL, April, 2011.

Rogers, E. M. (2005). *Diffusion of Innovations*. 5th ed. New York: Free Press.

Roux, D. J., Rogers, K. H., Biggs, H. C., Ashton, P. J., & Sergeant, A. (2006). Bridging the science-management divide: Moving from unidirectional knowledge transfer to knowledge interfacing and sharing. *Ecology and Society, 11*(1), 4.

Rycroft-Malone, J. (2004). The PARIHS framework: A framework for guiding the implementation of evidence-based practice. *Journal of Nursing Care Quality, 19*(4), 297-304.

Rycroft-Malone, J., Harvey, G., Seers, K., Kitson, A., McCormack, B., & Titchen, A. (2004). An exploration of the factors that influence the implementation of evidence into practice. *Journal of Clinical Nursing, 19*, 913-924. doi:10.1111/j.1365-2702.2004.01007.x

Rycroft-Malone, J., Kitson, A., Harvey, G., McCormack, B., Seers, K., Titchen, A., & Estabrooks, C. (2002). Ingredients for change: Revisiting a conceptual framework. *Quality and Safety in Health Care, 11*, 174-180. doi: 10.1136/qhc.11.2.174

Stern, H., Fung-Kee-Fung, M., Urbach, D., Smith, A., Brouwers, M., & Langer, B. (2007). *Sustainable improvement in quality indicators in Ontario's surgical oncology program (SOP).* Paper presented at the 2007 ASCO Annual Meeting Proceedings Part I. Vol 25, No. 18S (June 20 Supplement), 2007: 6638. Retrieved from: http://www.asco.org/ascov2/Meetings/Abstracts?&vmview=abst_detail_view&confID=47&abstractID=31088

Straus, S. E. (2009). The Action Cycle. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 59). Hoboken NJ: Blackwell Publishing Ltd.

Straus, S. E., Tetroe, J., & Graham, I. D. (2009). Knowledge to action: what it is and what it isn't. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 3-9). Hoboken: Blackwell Publishing Ltd.

Straus, S.E., Tetroe, J., Graham, I.D., Zwarenstein, M., & Bhattacharyya, O. (2009). Monitoring knowledge use and evaluating outcomes of knowledge use. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 151-164). Hoboken: Blackwell Publishing Ltd.

Thompson, D. S., O'Leary, K., Jensen, E., Scott-Findlay, S., O'Brien-Pallas, L., & Estabrooks, C. A. (2008). The relationship between busyness and research utilization: it is about time. *Journal of Clinical Nursing, 17*(4), 539-548. doi: 10.1111/j.1365-2702.2007.01981.x

Tsiakpini, L., Weichbold, V., Kuehn-Inacker, H., Coninx, F., D'Haese, P., & Almadin, S. (2004). LittlEARS Auditory Questionnaire. Innsbruck, Austria: MED-EL.

Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge.* Boston: Harvard Business School Press.

Wensing, M., Bosch, M., & Grol, R. (2009). Selecting, tailoring, and implementing knowledge translation interventions. In S. Straus, J. Tetroe & I. D. Graham (Eds.), *Knowledge Translation in Health Care: Moving from Evidence to Practice* (pp. 94-112). Hoboken: Blackwell Publishing Ltd.

Appendices

Appendix A: Characteristics of the guideline, practitioner, context and healthcare system that influences adoption and implementation.

Characteristics of the _____ that influences adoption and implementation

Guideline	Practitioner	Context	Broader System
relative advantage or utility	time/"busyness"	workplace structure	nature of financial arrangements
compatibility/ complexity	lack of authority to change practice	organizational agenda	support for change
costs	lack of support from organization for practice change	available resources/lack of access to journals	regulation of health professionals
flexibility/adaptability	perception of legitimacy of the source of the guideline	staff capacity	financial stability
Involvement	perception of quality/validity	staff "turn-over"	pressure from other health professionals or public
form/physical properties/presentation	lack of evidence/conflicting evidence	organization of care processes	
trialability/reversibility	habits/customs/chosen non-compliance	efficiency of the system	
visibility/observability	beliefs of peers	social capital of practitioners and organization	
centrality	social norms	level of inservice/continuing education opportunities	
pervasiveness/scope/ impact	attitude about guidelines	policy/procedure documentation	
magnitude/ disruptiveness/ radicalness	lack of outcome expectancy	leadership/good communication	
duration	lack of self-efficacy	relationships: practitioners and practitioners to managers	
collective action	lack of motivation		
	lack of awareness of existence of guideline		

Reprinted from "Knowledge translation in audiology: Promoting the clinical application of best evidence by S. T. Moodie, A. Kothari, M. P. Bagatto, R. C. Seewald, L. T. Miller, and S. D. Scollie (in press). *Trends in Amplification.* Copyright by Sage Publications. Reprinted with permission.

Appendix B: Characteristics of guidelines/innovations that might hinder or promote their implementation.

Characteristic	Description
relative advantage or utility	better than existing or alternative working methods
compatibility	consistent with existing norms and values
complexity	easy to explain, understand and use
costs	balance between cost and benefits, necessary level of investment
risks	degree of uncertainty about result or consequences
flexibility, adaptability	degree to which innovation can be adapted to needs/situation of target group
involvement	degree to which target group is involved in development and the potential that their input has modified or resulted in adaptation(s)
divisibility	degree to which parts can be tried out separately and implemented separately
visibility, observability	degree to which other people can see and observe the results
trialability, reversibility	degree to which an innovation can without risk be tried out, stopped, or reversed if it does not work
centrality	degree to which the innovation affects central or peripheral activities in the daily working routine
pervasiveness, scope, impact	how much of the total work is influenced by the innovation, how many persons are influenced, how much time it takes, and what the influence on social relationships is
magnitude, disruptiveness, radicalness	how many organizational, structural, financial and personal measures the innovation requires
duration	the time period within which the change must take place
form, physical properties	what sort of innovation or change it is (material or social, technical or administrative, etc)
collective action	degree to which decisions about the innovation must be made by individuals, groups or a whole institution
presentation	nature of presentation, length, clarity, attractiveness

Appendix C: Permission to use Figure 1 from Graham et al. (2006)

JOHN WILEY AND SONS LICENSE TERMS AND CONDITIONS

Oct 28, 2011

This is a License Agreement between Sheila TF Moodie ("You") and John Wiley and Sons ("John Wiley and Sons") provided by Copyright Clearance Center ("CCC"). The license consists of your order details, the terms and conditions provided by John Wiley and Sons, and the payment terms and conditions.

All payments must be made in full to CCC. For payment instructions, please see information listed at the bottom of this form.

License Number	2777061178710
License date	Oct 27, 2011
Licensed content publisher	John Wiley and Sons
Licensed content publication	Journal of Continuing Education in the Health Professions
Licensed content title	Lost in knowledge translation: Time for a map?
Licensed content author	Ian D. Graham,Jo Logan,Margaret B. Harrison,Sharon E. Straus,Jacqueline Tetroe,Wenda Caswell,Nicole Robinson
Licensed content date	Dec 1, 2006
Start page	13
End page	24
Type of use	Dissertation/Thesis
Requestor type	University/Academic
Format	Print and electronic
Portion	Figure/table
Number of figures/tables	1
Number of extracts	
Original Wiley figure/table number(s)	Figure 1
Will you be translating?	No
Order reference number	
Total	0.00 USD

Appendix D: Permission to use Table 4-2 from Grol & Wensing (2005).

Sheila Moodie

From:
Sent: Monday, October 31, 2011 12:41 PM
To:
Subject: Re: Permission to reproduce a Table from your work in my doctoral dissertation

Please use the tables for your dissertation

Success with your work and thesis

Richard Grol

----- Oorspronkelijk bericht -----
Van: Sheila Moodie
Aan: Grol, Richard
Cc: 'Sheila Moodie'
Verzonden: Mon Oct 31 16:58:14 2011
Onderwerp: Permission to reproduce a Table from your work in my doctoral dissertation

Hello Dr. Grol:

My name is Sheila Moodie and I am a PhD Candidate in the Faculty of Health Sciences at The University of Western Ontario in London, Ontario Canada.

I am writing to ask permission to include a Table shown in two of your publications that I cite, in my PhD dissertation. We require written permission to include them in our doctoral thesis documents. This permission must be included within the document prior to submission.

The Table I wish to reproduce was originally shown in a book chapter (as Table 4-2, page 65).

Grol, R., & Wensing, M. (2005). Characteristics of successful innovations. In R. Grol, M. Wensing, & M. Eccles, Improving Patient Care: The Implementation of Change in Clinical Practice (pp. 60-70). Oxford: Elsevier.

I had written Elsevier, the publisher, to obtain permission but have been told that the publication is out-of-print and therefore permission must come directly from the author.

The table is also shown on page 100 of this reference:

Grol, R. P. T. M., Bosch, M. C., Hulscher, M. E. J. L., Eccles, M., & Wensing, M. (2007). Planning and studying improvement in patient care: The use of theoretical perspectives. Milbank Quarterly, 85(1), 93-138.

however, their electronic permissions system indicates that permission must be obtained from the original source.

I am hoping that you will kindly grant me permission to use Table 4-2, page 65 from

Grol, R., & Wensing, M. (2005). Characteristics of successful innovations. In R. Grol, M. Wensing, & M. Eccles, Improving Patient Care: The Implementation of Change in Clinical Practice (pp. 60-70). Oxford: Elsevier

in my PhD dissertation and in any accompanying presentations of the material that I may make.

The title of my dissertation is: An integrated knowledge translation experience: Use of The Network of Pediatric Audiologists of Canada to facilitate the development of The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP) version 1.0

Appendix E: Permission to use Table 4 from Cox, R. M. (2005)

Copyright Clearance Center

1 PAYMENT 2 REVIEW **3 CONFIRMATION**

Step 3: Order Confirmation

Thank you for your order! A confirmation for your order will be sent to your account email address. If you have questions about your order, you can call us at 978-646-2600, M-F between 8:00 AM and 6:00 PM (Eastern), or write to us at info@copyright.com.

Confirmation Number: 10628483
Order Date: 11/04/2011

If you pay by credit card, your order will be finalized and your card will be charged within 24 hours. If you pay by invoice, you can change or cancel your order until the invoice is generated.

Payment Information

Sheila Moodie

Order Details

Journal of the American Academy of Audiology

Order detail ID:	58323876
ISSN:	1050-0545
Publication year:	2005
Publication Type:	Journal
Publisher:	AM ACADEMY OF AUDIOLOGY
Rightsholder:	AMERICAN ACADEMY OF AUDIOLOGY
Author/Editor:	Cox, R. M.
Your reference:	"Moodie thesis, Chapter 2"

Permission Status:	**Granted**
Permission type:	Republish or display content
Type of use:	Republish in a dissertation
Republication title:	An Integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of the UWO PedAMP v1.0
Republishing organization:	The University of Western Ontario
Organization status:	Non-profit 501(c)(3)
Republication date:	11/04/2011
Circulation/ Distribution:	20
Type of content:	Figure/ diagram/ table
Description of requested content:	Evidence-based practice in provision of amplification
Page range(s):	430
Translating to:	No Translation
Requested content's publication date:	01/01/2005

Appendix F: Permission to reprint two articles from SAGE Publications.

JOURNAL CONTRIBUTOR PUBLISHING AGREEMENT

For TRENDS IN AMPLIFICATION (the "Journal")
Owned by SAGE Publications, Inc.
Published by SAGE Publications, Inc., 2455 Teller Road, Thousand Oaks, CA 91320 ("SAGE")

TITLE OF CONTRIBUTION (the "Contribution"): Knowledge Translation in Audiology: Promoting the Clinical Application of Best Evidence.
CORRESPONDING CONTRIBUTOR: Sheila T. F. Moodie,
"Corresponding Contributor" refers to the lead author.
CONTACT INFORMATION: Sheila@nca.uwo.ca, National Centre for Audiology, The Univ. of Western Ontario
Elborn College, Room 2262K, London, ON Canada
ALL CO-AUTHORS: Anita Kothari, Marlene Bagatto, Richard Seewald, Linda Miller, Susan Scollie
As used herein, the lead author and all co-authors of the Contribution are collectively referred to as "Contributors" and individually as a "Contributor."

Please read the attached terms, then complete, sign and return this form by mail, courier, fax, or email to the Editorial Office at:

Erin Nelson, Managing Editor, Phone: 011 6 78 29 61 71 / email: enelson.sagepub@gmail.com

EXCLUSIVE LICENSE TO PUBLISH

Contributors represent and warrant that they own the copyright in the Contribution unless one of the following is checked:

☐ **Work made for hire for employer/Work done in the course of employment** – the Contribution was prepared by the following Contributor _____ at the request of such Contributor's employer and within the scope of the Contributor's employment, and copyright in the Contribution is owned by the Contributor's employer. (Both the Contributor **and** an authorized representative of the Contributor's employer must sign this Agreement.) Please name **Employer**: _____

☐ **U. S. Government work** – Contributors are employees of the United States Government **and** prepared the Contribution as part of their official duties. Please name **Govt Employer**: _____
(Please also read Section 2 of the attached "Terms of Agreement").

In consideration for publication of the Contribution in the Journal, Contributors hereby grant to SAGE the exclusive right and license to reproduce, publish, republish, prepare all foreign language translations and other derivative works, distribute, sell, license, transfer, transmit, and publicly display copies of, and otherwise use, the Contribution, in whole or in part, alone or in compilations, in all formats and media and by any method, device, or process, and through any channels, now known or later conceived or developed; and the exclusive right to license or otherwise authorize others to do all of the foregoing, and the right to assign and transfer the rights granted hereunder. To the extent that any right now or in the future existing under copyright is not specifically granted to SAGE by the terms of this Agreement, such right shall be deemed to have been granted hereunder.

By signing below, Contributors acknowledge their agreement to the above provisions **and** the terms and conditions stated in the attached "Terms of Agreement." Contributors represent and warrant that they have completed all information on the attached "Additional Contributor Information" accurately and thoroughly. **By signing this Agreement on behalf of all Contributors, Corresponding Contributor represents and warrants that he/she has received written permission from each Contributor to sign this Agreement on his or her behalf and to grant the exclusive license herein.** Corresponding Contributor understands that he/she has the option of having each Contributor sign a separate copy of this Agreement by contacting the Editorial Office for a version of this Agreement to be signed by each Contributor and returned directly to the Editorial Office.

For Contributors:

Signed: ..... Date: 1/11/11

For Employer (only required if **Work made for hire/done in the course of employment** box is checked)

Signed: ..... Date: .....
Authorized Representative: Name, Title:

For SAGE:

Allison Muddit, Executive Vice President, Higher Education Group

JOURNAL CONTRIBUTOR PUBLISHING AGREEMENT

For TRENDS IN AMPLIFICATION (the "Journal")
Owned by SAGE Publications, Inc.
Published by SAGE Publications, Inc., 2455 Teller Road, Thousand Oaks, CA 91320 ("SAGE")

TITLE OF CONTRIBUTION (the "Contribution"): Knowledge Translation in Audiology: Promoting the Clinical Application of Best Evidence.

CORRESPONDING CONTRIBUTOR: Sheila T. F. Moodie, The Univ. of Western Ontario

"Corresponding Contributor" refers to the lead author.

CONTACT INFORMATION: Sheila@nca.uwo.ca, National Centre for Audiology Elborn College, Room 2262K, London, ON Canada.

ALL CO-AUTHORS: Anita Kothari, Marlene Bagatto, Richard Seewald, Linda Miller, Susan Scollie

As used herein, the lead author and all co-authors of the Contribution are collectively referred to as "Contributors" and individually as a "Contributor."

Please read the attached terms, then complete, sign and return this form by mail, courier, fax, or email to the Editorial Office at:

Erin Nelson, Managing Editor, Phone: 011 6 78 29 61 71 / email: enelson.sagepub@gmail.com

EXCLUSIVE LICENSE TO PUBLISH

Contributors represent and warrant that they own the copyright in the Contribution unless one of the following is checked:

☐ **Work made for hire for employer/Work done in the course of employment** – the Contribution was prepared by the following Contributor _____ at the request of such Contributor's employer and within the scope of the Contributor's employment, and copyright in the Contribution is owned by the Contributor's employer. (Both the Contributor **and** an authorized representative of the Contributor's employer must sign this Agreement.) Please name **Employer**: _____

☐ **U. S. Government work** – Contributors are employees of the United States Government **and** prepared the Contribution as part of their official duties. Please name **Govt Employer**: _____
(Please also read Section 2 of the attached "Terms of Agreement").

In consideration for publication of the Contribution in the Journal, Contributors hereby grant to SAGE the exclusive right and license to reproduce, publish, republish, prepare all foreign language translations and other derivative works, distribute, sell, license, transfer, transmit, and publicly display copies of, and otherwise use, the Contribution, in whole or in part, alone or in compilations, in all formats and media and by any method, device, or process, and through any channels, now known or later conceived or developed; and the exclusive right to license or otherwise authorize others to do all of the foregoing, and the right to assign and transfer the rights granted hereunder. To the extent that any right now or in the future existing under copyright is not specifically granted to SAGE by the terms of this Agreement, such right shall be deemed to have been granted hereunder.

By signing below, Contributors acknowledge their agreement to the above provisions **and** the terms and conditions stated in the attached "Terms of Agreement." Contributors represent and warrant that they have completed all information on the attached "Additional Contributor Information" accurately and thoroughly. **By signing this Agreement on behalf of all Contributors, Corresponding Contributor represents and warrants that he/she has received written permission from each Contributor to sign this Agreement on his or her behalf and to grant the exclusive license herein.** Corresponding Contributor understands that he/she has the option of having each Contributor sign a separate copy of this Agreement by contacting the Editorial Office for a version of this Agreement to be signed by each Contributor and returned directly to the Editorial Office.

For Contributors

Signed: ..... Date: 1/11/11

For Employer (only required if **Work made for hire/done in the course of employment** box is checked)

Signed: ..... Date: .....
Authorized Representative: Name, Title:

For SAGE:

Allison Muddit, Executive Vice President, Higher Education Group

Appendix G: Ethics approval forms for survey of factors influencing evidence-based practice among Canadian audiologists.

Office of Research Ethics
The University of Western Ontario
Room 00045 Dental Sciences Building, London, ON, Canada N6A 5C1
Telephone:
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. A. Johnson
Review Number: 13971E **Review Level:** Expedited
Review Date: February 15, 2008
Protocol Title: A survey of factors influencing the development of evidence-based practice among audiologists
Department and Institution: Faculty of Health Sciences, University of Western Ontario
Sponsor:
Ethics Approval Date: April 17, 2008 **Expiry Date:** January 31, 2009
Documents Reviewed and Approved: UWO Protocol, Letter of Information
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced study on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. John W. McDonald

This is an official document. Please retain the original in your files.

cc: ORE File

Office of Research Ethics
The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone:
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. A.M. Johnson
Review Number: 13971E **Revision Number:** 1
Review Date: December 10, 2008 **Review Level:** Expedited
Protocol Title: A survey of factors influencing the development of evidence-based practice among audiologists
Department and Institution: Faculty of Health Sciences, University of Western Ontario
Sponsor:
Ethics Approval Date: December 12, 1008 **Expiry Date:** January 31, 2009
Documents Reviewed and Approved: Revised study recruitment. Letter of Information.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert

This is an official document. Please retain the original in your files.

cc: ORE File

Office of Research Ethics
The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone:
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. A.M. Johnson
Review Number: 13971E **Revision Number:** 2
Review Date: February 6, 2009 **Review Level:** Expedited
Protocol Title: A survey of factors influencing the development of evidence-based practice among audiologists
Department and Institution: Faculty of Health Sciences, University of Western Ontario
Sponsor:
Ethics Approval Date: February 6, 2009 **Expiry Date:** December 31, 2010
Documents Reviewed and Approved: Revised Study End Date
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert

This is an official document. Please retain the original in your files.

cc: ORE File

Appendix H: Ethics approval form for knowledge-to-action study

Office of Research Ethics

The University of Western Ontario
Room 4180 Support Services Building, London, ON, Canada N6A 5C1
Telephone:
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Ms. S.T.F. Moodie
Review Number: 16410E **Review Level:** Expedited
Review Date: August 12, 2009
Protocol Title: Design, Implementation and Evaluation of a Protocol for Monitoring Hearing-Related Behaviours in Infants and Children Receiving Audiological Services: A Knowledge-to-Action Study
Department and Institution: Communication Sciences & Disorders, University of Western Ontario
Sponsor: CIHR-CANADIAN INSTITUTE OF HEALTH RESEARCH
Ethics Approval Date: August 26, 2009 **Expiry Date:** August 31, 2012
Documents Reviewed and Approved: UWO Protocol, Letter of Information and Consent (August 14, 2009), Survey Cover Letter.
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced study on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. Joseph Gilbert

This is an official document. Please retain the original in your files.

cc: ORE File

Curriculum Vitae

Name: **Sheila Theresa Frances Moodie**

Post-secondary Education and Degrees:

The University of Western Ontario
London, Ontario, Canada
1986-1990 B.Sc.$_{CD}$

The University of Western Ontario
London, Ontario, Canada
1990-1992 M.Cl.Sc.

The University of Western Ontario
London, Ontario, Canada
2007- present Ph.D. Candidate

Honours and Awards

Frederick Banting and Charles Best Canada Graduate Scholarship – Doctoral Award: Canadian Institutes of Health Research (200710CGD-188113-171346)
2008, 2009, 2010

Related Work Experience

Research Associate
Child Amplification Laboratory,
The National Centre for Audiology,
The University of Western Ontario, London, ON
1992-1995; 2002-present

Recent Publications:

Bagatto, M., **Moodie, S.**, Scollie, S., Seewald, R., Moodie, K., Pumford, J., & Liu, K.P. (2005) Clinical protocols for hearing instrument fitting in the Desired Sensation Level method. *Trends in Amplification, 9*(4): pp. 199-226.

Bagatto, M., Seewald, R., Scollie, S. & **Moodie, S.** (2006) Pediatric hearing instrument fitting: Key elements for getting it right from the start. *Audio Infos* – Special ENT: 2-6.

Bentler, R., Eiler, C., Hornsby, B., **Moodie, S.T.,** Olson, L. & Valente, M. (2007). Practical approaches to evidence based practice. *Hearing Review*, 14(6):36,40,41.

Moodie S.T., Johnson A., & Scollie, S. (2008). Evidence-based practice and Canadian audiology. *Canadian Hearing Report* 2008; 3(1): 12-14.

Polonenko, M.J., Scollie, S.D., **Moodie, S**., Seewald, R.C., Laurnagaray, D., Shantz, J., et al. (2010). Fit to targets, preferred listening levels, and self-reported outcomes for the DSL v5.0a hearing aid prescription for adults. *International Journal of Audiology, 49*(8), 550-560.

Bagatto, M.P., Brown, C.L., **Moodie, S.T**., & Scollie, S.D. (2011) External validation of the LittlEARS® Auditory Questionnaire with English-speaking families of Canadian children with normal hearing, *International Journal of Pediatric Otorhinolaryngology*, 75(6), 815-817.

Recent Publications continued:

Bagatto, M.P., **Moodie, S.T.,** Malandrino, A., Richert, F., Clench, D., & Scollie, S.D. (2011). The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP). *Trends in Amplification, 15*(1), 57-76. doi: 10.1177/1084713811420304

Bagatto, MP, **Moodie, S.T.,** Seewald, RC, Bartlett, DJ & Scollie, SD. (2011). A Critical Review of Audiological Outcome Measures for Infants and Children, *Trends in Amplification,15*(1), 23-33. doi: 10.1177/1084713811412056

Moodie, S.T. (2011). Spotlight on Science: Implementation Science. *Canadian Hearing Report, 6*(3):23-26.

Moodie, S.T. (2011, October). 20Q: Moving from evidence to practice: Can knowledge translation and implementation science help audiology get there? Retrieved from http://www.audiologyonline.com/articles/article_detail.asp?article_id=2392

Moodie, S.T., Bagatto, M.P., Miller, L.T., Kothari, A., Seewald, R.C., & Scollie, S.D. (2011). An integrated knowledge translation experience: Use of the Network of Pediatric Audiologists of Canada to facilitate the development of the University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP v1.0). *Trends in Amplification, 15*(1), 34-56. doi: 10.1177/1084713811417634

Moodie, S.T., Kothari, A., Bagatto, M.P., Seewald, R.C., Miller, L.T., & Scollie, S.D. (2011). Knowledge translation in audiology: Promoting the clinical application of best evidence. *Trends in Amplification, 15*(1), 5-22. doi: 10/1177/1084713811420740

Articles in Refereed Conference Proceedings

Moodie, S.T., Scollie, S.D., Bagatto, M.P. & Seewald, R.C. (2006). What's new in prescriptive fittings up north for adults and children? In C Palmer & RC Seewald, (Eds.), *Hearing Care for Adults 2006: Proceedings of the First International Adult Conference*, (pp. 115-132). Stäfa Switzerland: Phonak. AG.

Bagatto, M.P**., Moodie, S.T.**, & Scollie, S.D. (2011). Beyond matching targets: An approach to outcome evaluation in pediatric hearing aid fitting. In: Seewald R.C., & J. Bamford (Eds.), *A Sound Foundation Through Early Amplification: Proceedings of an International Conference,* (pp. 229-244). Stäfa Switzerland: Phonak, AG.

Technical Writings

Scollie, S.D., Seewald, R.C., **Sinclair-Moodie, S.T.,** Bagatto, M.P., Cornelisse, L.E. & Beaulac, S. (2005). *A software implementation of the Desired Sensation Level (DSL m[i/o] Method for fitting linear gain and wide-dynamic-range compression hearing instrument, Version 5.0.* National Centre for Audiology, The University of Western Ontario, London, ON.

Scollie, S.D., Seewald, R.C., **Moodie, S.T.,** Bagatto, M.P., & Beaulac, S. (2007). *An update to DSL 5: WDRC targets for severe to profound hearing loss.* National Centre for Audiology, The University of Western Ontario, London, ON.

Bagatto, M.P., **Moodie, S.T.**, & Scollie, S.D. (2010). The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP): A Training Manual for Clinicians. Child Amplification Laboratory, National Centre for Audiology, *The University of Western Ontario*, London, ON.

Presentations

Moodie, S. T. (2009). Clinician fit-to-DSL targets: Preliminary data from a network study. *Audiology Online.* Retrieved from: http://www.audiologyonline.com/ceus/livecoursedetails.asp?class_id=14417

Moodie, S. T. (2010, October 6). *Engaging audiologists in research: The Network of Pediatric Audiologists of Canada.* Paper presented at the Canadian Academy of Audiology (CAA) Conference, Montreal, Quebec, Canada.