Adult Cochlear Implantation in Canada: Results of a Survey

Implantation cochléaire chez les adultes au Canada: Résultats d'une enquête

Elizabeth M. Fitzpatrick
Lynne Brewster

Abstract

This paper presents the results of a survey of the adult cochlear implant centres in Canada. The survey was conducted in 2008 to examine trends in the cochlear implantation of adults in Canada between 1995 and 2007. All 12 Canadian programs, including nine surgical and three non-surgical centres, returned the questionnaire. The results showed that there has been significant growth in adult cochlear implantation over the past 12 years, particularly since 1999. By 2007, a total of 2,534 adults had received implants in Canadian centres, 270 prior to 1995 and 2264 in the twelve-year period covered by this survey. In the past five years (2003 through 2007), on average, 296 patients have received implants annually in Canada. The majority of adults who receive implants are under age 60; however, a notable trend in recent years is the implantation of adults over the age of 80 years. Major areas of concern for the centres are related to clinical resources (10 of 12 centres), clerical support (5 of 12) and surgical services (4 of 12). Respondents perceived that patients were most concerned about: 1) the costs of maintaining and upgrading their devices and, 2) access to both assessment and surgery in a timely manner. Respondents rated borderline audiologic candidacy, bilateral implantation and bimodal hearing (use of a cochlear implant and hearing aid) as the primary issues of interest for clinical discussions. These data provide baseline information about adult cochlear implant services in Canada that may assist in program planning and resource allocation.

Abrégé

Cet article présente les résultats d'une enquête effectuée auprès des centres d'implants cochléaires pour adultes au Canada. L'enquête a été menée en 2008 pour examiner les tendances en implantation cochléaire des adultes au Canada entre 1995 et 2007. Les 12 programmes canadiens, dont neuf centres chirurgicaux et trois centres non chirurgicaux, ont répondu et renvoyé le questionnaire. Les résultats ont montré qu'il y a eu une croissance importante de l'implantation cochléaire chez les adultes dans les 12 dernières années, en particulier depuis 1999. En 2007, un total de 2 534 adultes avaient reçu des implants dans les centres canadiens; on en comptait 270 avant 1995 et 2 264 pendant la période de douze ans couverte par cette étude. Au cours des cinq dernières années (2003 à 2007), une moyenne de 296 patients a reçu annuellement des implants au Canada. La majorité des adultes ayant reçu des implants était âgée de moins de 60 ans. Cependant, une tendance dans les dernières années a été remarquée. Il s'agit de l'implantation chez des adultes de plus de 80 ans. Les centres sont principalement concernés par les ressources cliniques (10 des 12 centres), le personnel de soutien (5 sur 12) et les services chirurgicaux (4 sur 12). Les répondants ont remarqué que les patients étaient plus inquiets au sujet : 1) des coûts de l'entretien et de mise à jour de leurs appareils et 2) d'un accès à l'évaluation et à la chirurgie dans les meilleurs délais. Les répondants ont déterminé le choix des candidats potentiels dont les résultats audiométriques sont à la limites des critères de sélection, l'implantation bilatérale et l'audition bimodale (l'utilisation d'un implant cochléaire et d'une aide auditive) comme sujets principaux d'intérêt pour des discussions cliniques. Ces données fournissent des renseignements de base au sujet des services d'implantation cochléaire pour adultes au Canada, qui pourraient aider à la planification de programme et à l'allocation des ressources.

Key words: cochlear implant, adult, survey, services, (re)habilitation

Elizabeth M. Fitzpatrick, PhD
Faculty of Health Sciences,
University of Ottawa and
Children's Hospital of
Eastern Ontario Research
Institute
Ottawa, Ontario
Canada

Lynne Brewster, PhD
Program Head, Saskatchewan
Pediatric Auditory
Rehabilitation Centre
Saskatoon, Saskatchewan
Canada

Cochlear implant technology has dramatically impacted the management of individuals with severe to profound hearing loss and has become a standard intervention in much of the world for both adults and children with significant hearing loss. While the procedure was limited to individuals with profound deafness and no benefit from acoustic hearing aids in the early 1990s (Rosen, 1990), criteria have since expanded to include individuals with open-set speech discrimination and severe hearing impairment (Rubinstein, Parkinson, Tyler, & Gantz, 1999). Worldwide, an estimated 150,000 individuals have received cochlear implants. In Canada, children and adults are eligible for cochlear implants through designated provincial cochlear implant programs. Since the 1990s, the number of cochlear implants provided annually as well as the number of Canadian centres has grown with the expansion in candidacy criteria and subsequent increases in provincial funding allocations.

A recent Canadian survey reported that 1,562 children received cochlear implants at nine surgical centres across Canada before 2005 (Fitzpatrick & Brewster, 2008), and that nationally there was rapid growth in the number of pediatric surgeries performed since 2000. The *Canadian Association of Speech-Language Pathologists and Audiologists* has developed and published two position statements relative to pediatric cochlear implantation (Canadian Association of Speech-Language Pathologists and Audiologists, 2006; Durieux-Smith, Delicati, Brewster, Fitzpatrick, & Phillips, 1995). However, no similar information has been published related to adult cochlear implantation. Consistent with trends in pediatric care, the availability and practice of cochlear implantation has varied throughout Canada with different programs being introduced and funded at different times in the past 10 to 15 years. In the absence of a national database, no information has been published about the number of adults receiving cochlear implants in Canada, the growth in cochlear implantation in the past 10 to 15 years and the trends in cochlear implant candidacy.

In order to supplement our previous work in pediatric cochlear implantation, a survey of the Canadian cochlear implant centres was undertaken in 2008 to collect Canadian data regarding practices in cochlear implantation for adults. The primary objectives of the survey were to: 1) obtain a profile of adult cochlear implantation in Canada including the numbers and ages of adults receiving implants and, 2) to elicit centres' concerns related to issues in adult cochlear implantation. Ultimately, we sought to describe the number and characteristics of adult patients implanted in Canada, the trends in adult implantation and cochlear implant centres' perceptions of current issues.

Methodology

The research consisted of a cross-sectional survey of all adult Canadian cochlear implant centres in 2008. Using the previous pediatric survey as a guideline (Fitzpatrick & Brewster, 2008), questions were developed with input from practicing clinicians in adult programs. Consistent with the definitions used in the pediatric survey, and reflecting service provision in the Canadian context (Fitzpatrick & Brewster, 2008), a cochlear implant centre/program was defined as a hospital program that provided cochlear implantation including candidacy evaluation, surgery and follow-up or a program that provided cochlear implant services without on-site surgery. Prior to undertaking the survey, we identified nine cochlear implant programs located in six provinces that provide a surgical component and three additional cochlear implant programs that access surgery in other provinces. These centres were identified through an electronic mail list that includes contact information for all Canadian cochlear implant programs. These 12 centres constituted the sample for this study.

The final questionnaire, entitled, "Adult Cochlear Implant Survey" was a four-page survey consisting of 22 questions that was broadly organized into three sections covering:

- A broad description of centre services, team and the numbers and age characteristics of adult patients implanted annually from 1995 to 2007 (nine questions).
- Rehabilitation practices and access as well as reasons for not accessing rehabilitation (five questions).
- Practitioners' views on program and patient concerns as well as miscellaneous questions on bilateral implants and immunization (eight questions).

In section one, centres were asked to list the number of patients implanted annually from 1995 to 2007 according to four age categories: less than age 60 years, 60 to 70 years, 71 to 80 years and greater than age 80 years. The centres were also asked to provide the overall number of patients implanted prior to 1995. In section two, centres were asked to identify the number of patients who had received rehabilitation and FM systems. Section three addressed practitioner perspectives of services. Specific issues were raised in the pediatric survey (Fitzpatrick & Brewster, 2008) that was completed two years earlier related to available resources and bilateral cochlear implantation. Therefore, these items were specifically probed in the adult questionnaire. All data were pooled and analyzed using descriptive statistics where appropriate.

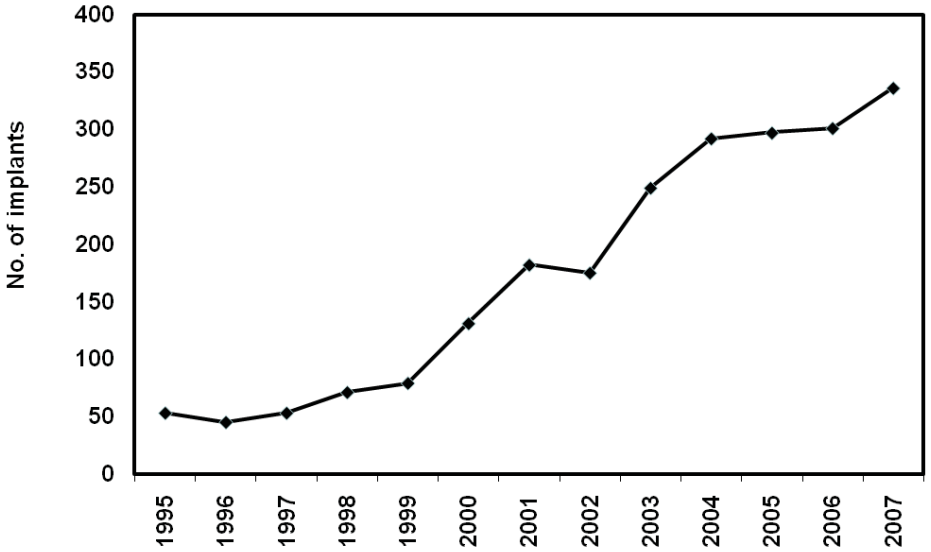
The research received ethics approval from the University of Ottawa Research Ethics Board. The survey was sent electronically to the 12 program coordinators (or designated individuals) in October 2008 followed by two reminder notices. The coordinators were invited to complete the survey on behalf of the cochlear implant team.

Results

Centre Characteristics

All 12 Canadian programs, as listed in Table 1, returned a completed survey. Eight of the 12 cochlear implant centres provide both adult and pediatric services but were requested to report only adult-related information. Adult cochlear implant services are provided through a single provincial cochlear implant centre in all but two of

Figure 1:
Number of cochlear implants received by adults in Canada during the years 1995 to 2007 (n= 2264)



the provinces with programs. Ontario has three regional centres in Toronto, London and Ottawa. Alberta has two centres in Edmonton and Calgary. Four provinces, Prince Edward Island, New Brunswick, Manitoba and Saskatchewan, do not provide surgical services within the province. However, all provinces except Prince Edward Island identified a dedicated cochlear implant service. There are no cochlear implant centres in Canada's three northern territories. All nine surgical programs reported that they provide candidacy selection and surgery; seven of these centres indicated that they provided hearing aid selection and fitting and all identified cochlear implant rehabilitation as a component of their service. The three non-surgical centres conduct candidacy assessments and provide follow-up that includes programming of the speech processor. One of the three centres also reported the provision of cochlear implant rehabilitation.

Team composition varied amongst the centres. Some centres reported only one or two team members in addition to the surgeon(s) and audiologist(s) while others reported a large number and range of professionals. All but one centre reported having dedicated administrative support or a program assistant. Six programs indicated that a speech-language practitioner was part of the team. Six also reported social workers to be team members while three programs included a psychologist. One centre reported the inclusion of a psychiatrist. Three programs specifically reported the inclusion of a researcher as part of the cochlear implant team and two indicated that a dedicated technical assistant was available. In contrast to the pediatric programs reports (Fitzpatrick & Brewster, 2008), centres did not generally identify the inclusion of services located outside the cochlear implant centre.

Funding

All nine hospital surgical programs are publicly funded through their respective provincial ministries of health; one centre also reported funding from a foundation, and one reported some support through fundraising efforts. The majority (7 of 9) of the surgical centres reported that implants are allocated on a quota system. In some cases, the number of devices allocated was reported as a total number of implants for both adults and children. The provinces with non-surgical programs did not report funding based on a quota system. Five centres reported that partial funding is provided for speech processor upgrades.

Four of the centres indicated using devices from three manufacturers: Advanced Bionics, Cochlear Corporation and Med-El. Three provide devices by two manufacturers and four reported devices from a single manufacturer. One satellite centre reported that it was not involved in device purchases.

Wait times

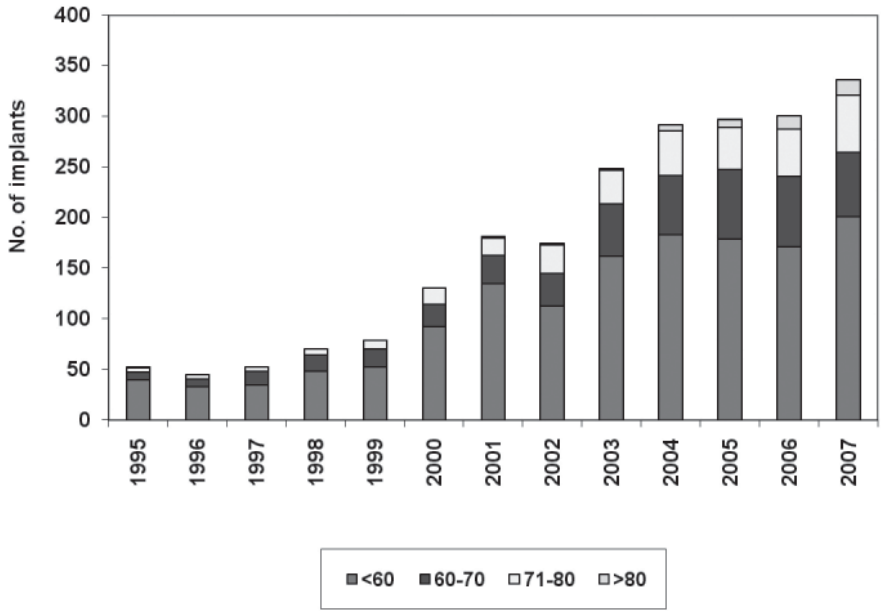
The wait times for assessment and surgery varied considerably across the centres. Most frequently, patients wait three to six months for a cochlear implant assessment. Four centres reported greater than a 12-month wait for assessment while only two reported less than three months. Nine of the 12 centres reported that patients waited more than 12 months from the time of initial referral to surgery; two centres reported 6 to 12 months and only one reported a wait period of less than six months. However, no information was specifically collected regarding the time interval from determination of candidacy to surgery. Two centres with more than 12-months wait time to assessment indicated that surgery was performed within six months following candidacy approval.

Expansion of Adult Cochlear Implantation Services

At the time of this survey, unilateral cochlear implantation remained the standard of care for adult patients, although two centres reported that funding had been approved for bilateral implants in adults. Two other centres indicated that funding for bilateral implantation had been approved for specific patients such as those with post-meningitic deafness or blindness. A total of 37 adults were reported to have received bilateral implants by the end of 2007.

By 2007, a total of 2,534 adults had received cochlear implants in Canada, 270 prior to 1995 and 2,264 from 1995 to 2007. The number of adults who received cochlear

Figure 2:
Number of cochlear implants received by adults in Canada according to four age groups during 1995 to 2007 (n=2264)



implants in Canadian centres each year from 1995 to 2007 is displayed in Figure 1. These data reflect the number of *individuals* who received cochlear implants, rather than the number of cochlear implant devices. Therefore, the figure does not account for re-implantation of failed devices or bilateral cochlear implantation.

As may be seen in Figure 1, there has been considerable growth in the total numbers of surgeries. The number of surgeries remained in the range of approximately 50 surgeries per year in the first few years of implant availability (1995 to 1997). In the ten years from 1998 to 2007, the number of implantation ranged from 71 implants (1998) to 336 implants (2007). The number of adults implanted in the last 5 years covered by this survey (2003 to 2007) appears to have stabilized with an average of 296 adult patients receiving cochlear implants annually. The most marked growth period occurred from 1999 to 2001 when the number of annual surgeries more than doubled from 79 to 182. This may have reflected, in part, the addition of the centres in the eastern provinces (accounting for approximately 25% of the increase in the number of implants) and therefore greater accessibility to implants across Canada. In general, a review of the data suggests a substantial increase in the number of implants across the country. Four of the cochlear implant programs implanted two times more devices in 2001 than in 1999. This growth closely parallels that of the pediatric centres where there the number of implant surgeries more than doubled from 72 in 1997 to 165 in 2001 (Fitzpatrick & Brewster, 2008). Considerable annual variability was noted for some centres. This may reflect variability in demand or short-term/one-time funding increases to deal with extensive waiting lists. No centre reported a sustained decrease in the number of implants performed annually.

Changes in age at cochlear implantation

Figure 2 displays the number of adults implanted in Canadian centres between 1995 and 2005 by age and year of implantation. Some trends are apparent in the age at implantation over the past 12 years captured in this survey. As shown in Figure 2, patients under the age of 60 represented 70 to 80% of the population implanted from 1995 to 2000 but in recent years represent closer to 60% of all adults receiving implants. Prior to 2001, only one patient over 80 years of age received an implant in Canada; however this age group accounted for approximately 5% (15/336 in 2007) of the population implanted in the 2001 to 2007 data. Patients over 70 years of age now account for about 20% of the population. This represents a 10% growth from the 1995 to 2001 time period. Of the total population implanted in the twelve-year period, 64.0% (1,449/2,264) received their implants under the age of 60 and 2.1% (48/2,264) of patients received implants over the age of 80.

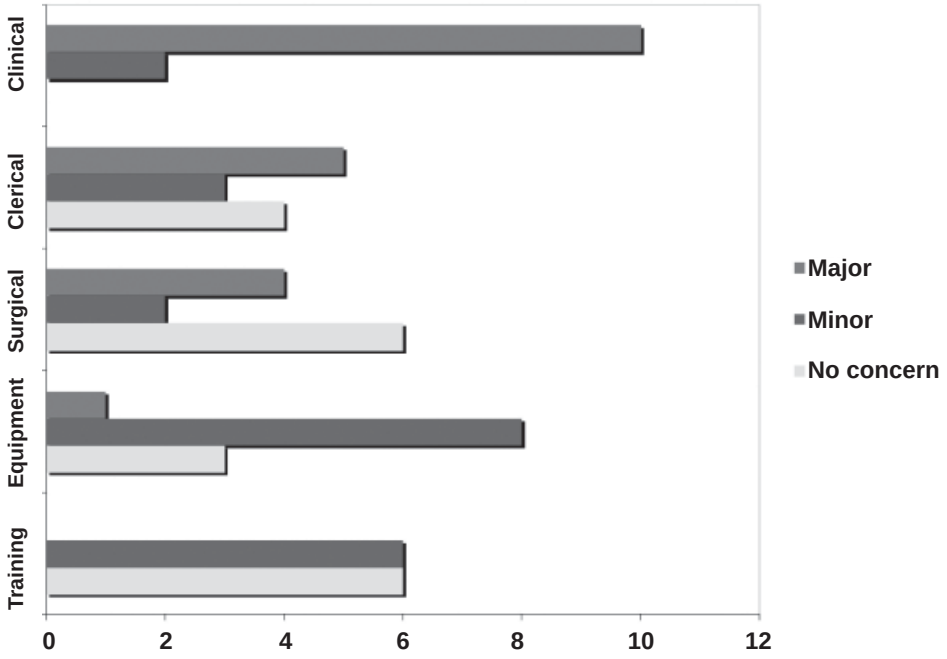
Rehabilitation

Centres described various levels of rehabilitation services. In contrast to information collected in the pediatric survey, the programs did not report the provision of services by other providers in the community. All but one non-surgical centre identified rehabilitation as a component of their core services. However, the number of patients estimated to access rehabilitation services in the clinics ranged from 0% to more than 50%. Four centres reported that no rehabilitation was provided and three centres indicated that less than 25% of patients accessed rehabilitation. One centre reported that 25% to 50% of patients accessed care, and the remaining four programs reported that 50% to 100% of patients received some form of rehabilitation. Clinics reported no or limited access to rehabilitation services outside the cochlear implant centre. When asked the reasons why patients did not receive post-implant rehabilitation, seven of the 12 clinics stated that the majority of their patients did not need rehabilitation services post-implant. Three centres noted that rehabilitation was not available to patients. Although FM fitting and monitoring were generally a part of the services provided, the number of patients estimated to use an FM system in conjunction with their cochlear implant ranged from 0% to 15%.

Cochlear implant centre concerns

Figure 3 provides the centres' rating of various clinical challenges that were described in the questionnaire as: (a) shortage of clinical positions, (b) shortage of clerical

Figure 3:
Adult cochlear implant centre concerns rated as major, minor and no concern



positions, (c) access to surgical services, d) access to clinical training, (e) funding for clinical equipment and (f) other. The shortage of clinical personnel emerged as a major concern for 10 of the 12 centres, followed by shortage of clerical support (5 of 12 centres) and access to surgical services (4 of 12). Access to clinical training and clinical equipment were of no concern or minor concern to most centres. The other category included various concerns listed by individual centres: limited funding for patient devices, limited space and access to rehabilitation services.

Patient concerns were perceived by their cochlear implant centres to be mainly in the areas of the costs of maintaining and upgrading equipment (6 of 12 centres), access to both assessment (5 of 12) and surgical services (6 of 12). Both the reliability of equipment and the distance to the implant centres were also perceived to be of major (4 of 12 centres) or minor (4 and 5 centres) concern for adult cochlear implant users.

Other Clinical Considerations

Questions on the survey examined a variety of other areas including immunization practices, remote programming or other patient services. The questionnaire also probed the centres' views related to desirable improvements of cochlear implant devices and current topics for discussion in adult implantation. Nine centres stated that there was a requirement for immunization against meningitis pre-surgery while the others indicated that it was strongly recommended. No centre reported the provision of remote speech processor programming or other patient services. In the final component of the questionnaire, the centres' views of desirable technological innovations included primarily improvements in battery life, device reliability and the availability of a variety of speech processor changes to improve programming. The priority issues for future discussions between Canadian centres included: (a) borderline candidacy issues, (b) bilateral implantation and (c) bimodal hearing (cochlear implant combined with hearing aid). Candidacy issues and outcome measures were also identified as important although they received a slightly lower priority from the seven centres that provided a ranking.

Discussion

This paper summarizes the results of a survey that examined the status of adult cochlear implantation in Canada. The report is intended to extend previous data collected on pediatric implantation in Canada and to provide a more complete profile of the Canadian landscape in cochlear implantation services. The questionnaire collected information from all Canadian cochlear implant centres in nine provinces to capture a snapshot of service provision in adult implantation from 1995 to 2007. Currently, adult cochlear implant surgical services are available in nine centres. Three other programs provide candidacy evaluation, and/or cochlear implant management. The majority of centres were already providing services prior to 1995 but two new surgical centres in Nova Scotia and Newfoundland and one satellite program in New Brunswick were established after 1998.

Combining the data from the previous pediatric and the current adult survey, more than 4,200 adults and children had received cochlear implants in Canada by 2007. The 2,534 adults and estimated 1,710 children receive care through 12 designated implant programs. This translates to 470 to 500 individuals who receive implants annually, estimated as 296 adults and 174 children based on the pediatric survey data (Fitzpatrick & Brewster, 2008).

To put these numbers into perspective with regards to the population base, there were approximately 128 implantations per million Canadians, based on the 2008 Canada Census, which found that there were 33 million people living in Canada. For comparison, the United Kingdom, with a population of approximately 61 million (Central Intelligence Agency, 2009), had a cochlear implantation rate of 90 per million population while Australia had a rate of 180 per million (Royal National Institute for Deaf People, 2007). While this comparison is not exhaustive, it indicates that Canada is midfield by international standards.

In Canada, the overwhelming majority of adults continue to receive unilateral cochlear implants. Bilateral implants for adults are not routinely funded in the majority

of provinces and only 37 adult patients were reported to have received bilateral implants by 2007. Due to the current emphasis on the importance of binaural hearing, the consideration of bilateral implantation has become an important issue for Canadian centres. A recent survey of practice variations in Canada indicated that while all centres recommend that patients use a hearing aid in combination with a cochlear implant, the number of patients using bimodal stimulation ranged from 15 to 80% of patients across the programs (Maessen & Schramm, 2009).

Given the expanded indications for cochlear implants since the early 1990s, it was not surprising to observe considerable growth in the number of adults implanted annually, increasing from 53 in 1995 to 336 in 2007. One notable difference in practice was the change in age at implantation. In the early years, primarily individuals in the "under 60" age bracket were implanted while current practice includes the implantation of more individuals at older ages. Currently, the "under 60" population accounts for approximately 60% of implants. In particular, implantation of a larger number of individuals over the age of 80 is a trend observed in recent years, and this population accounted for just over 5% of the implants in 2007. In the recent practice survey (Maessen & Schramm, 2009), age at implantation was identified as the least important factor in candidacy selection. This change may reflect greater availability of implants or a greater comfort level on the part of the implant centres given the positive results reported for elderly individuals (Haensel, Ilgner, Chen, Thuermer, & Westhofen, 2005; Vermeire et al., 2005). This trend appears to be consistent with practices reported in studies that show an increased tendency toward the implantation of more elderly individuals.

Contrary to the pediatric centres, all of which offered some level of rehabilitation, several adult programs (7 of 12) indicated that less than 25% of adults access rehabilitation services. In general, from the perspective of the implant centres, this appeared to be due to the lack of need for rehabilitation or in some cases the lack of availability of services. No information regarding the perceived need for rehabilitation was collected from the cochlear implant users themselves. Major concerns for the respondents centered on the availability of resources, particularly clinical and support personnel as well as surgical services for some centres. In general, education and availability of cochlear implant audiologic equipment were not perceived to present barriers to service provision. In summary, with the exception of one centre that highlighted the need for additional implant devices, the funding for unilateral implant devices was not raised as a concern; however, clinical and surgical resources emerged as a very important issue for several Canadian cochlear implant centres.

Consistent with the concerns related to assessment and surgical resources, wait times for candidacy assessment were more than 12 months for six of the 12 centres and only two were able to address the need in less than six months. The time to surgery from initial referral ranged from less than six months to more than 12 months for nine centres. Recently, the Canadian Association of Speech-Language Pathologists and Audiologists, through the Pan-Canadian Alliance Wait Times Project has established wait times for various services including cochlear implantation (Canadian Association of Speech-Language Pathologists and Audiologists, 2009). The recommended maximum time for adult patients for a first appointment is three months and for surgery it is six months from determination of candidacy. Based on our survey, the time to cochlear implant candidacy assessment in Canada is markedly longer than that recommended by these guidelines. Although our questionnaire did not specifically address surgical wait times after the initial candidacy assessment, it follows that surgical times are significantly delayed compared to recommended guidelines. This survey did not probe the reasons for delay to cochlear implant surgery and therefore we cannot make definitive statements about the causes. Anecdotal information from centres would suggest two likely reasons for delay, namely lack of surgery time and the quota system for devices which limits the number of available devices annually in some provinces.

A limitation of this research is that given the time required to collect and analyze the information, current issues and practices in cochlear implantation have not been captured in this questionnaire, which only documents services up to the end of 2007. The questionnaire was completed by program coordinators who are audiologists and, therefore, the answers may not have fully reflected the views and concerns of other team members, although centres were invited to complete the questionnaire on behalf of the entire program. In an effort to keep the survey of reasonable length, specific data regarding referrals and the impact of changing criteria on growth were not collected.

Building on a previous Canadian pediatric survey, this brief questionnaire was developed to collect descriptive information about adult cochlear implantation in Canada and was not intended to be used as a tool to provide a critical review of Canadian cochlear implant services. We believe the data presented here reflect an accurate picture of the Canadian landscape and highlight issues and concerns raised by clinicians working in adult cochlear implantation in a publicly funded context. Although this survey is limited by the rapid changes in cochlear implantation technology, candidacy criteria and standards of practice, we suggest that the findings will be of interest to service providers and to those who make health policy decisions. Overall, the results of this survey suggest that cochlear implant teams working in Canadian adult cochlear implant centres are relatively satisfied with the scope and location of services in this country. Nevertheless, these data suggest some areas for improvement, particularly in the area of resources. The greatest concern raised by the centres was the availability of professional and support services to manage the increasing workloads associated with the growth in adult cochlear implantation. Access to surgical services in a timely manner was also a key concern in some cochlear implant programs.

The findings from this survey are a starting point for identifying areas of clinical and research needs in cochlear

implantation. At the time of this writing, the majority of Canadian centres are providing unilateral cochlear implantation as standard adult care. An important aspect of cochlear implantation going forward is expected to be the increasing demand for bilateral implantation, which has not yet become standard practice in Canadian centres in contrast to practices reported in the United States and some European countries. Given this new demand to be placed on the system, this survey highlights the need to further examine adult cochlear implant resources in Canada in two key areas: (a) the critical patient management resource issue and (b) the surgical wait times in Canadian centres for unilateral implants that exceed the recommendations by the Pan-Canadian Alliance Wait Times Project. This information provides a baseline of Canadian adult cochlear implant services to the year 2007, against which future program development and growth can be measured.

Reference List

Canadian Association of Speech-Language Pathologists and Audiologists. (2006). Position paper on cochlear implants in children. *Journal of Speech-Language Pathology and Audiology, 30(4)*, 254-256.

Canadian Association of Speech-Language Pathologists and Audiologists. (2009). *Recommended wait times for speech-language pathology and audiology related services*. Retrieved August 26, 2009, from http://www.caslpa.ca/english/profession/wait_list_cochlear_implants.asp.

Central Intelligence Agency (2009). *The World Factbook*. Retrieved August 23, 2009, from http://www.cia.gov/library/publications/the-world-factbook/geos/uk.html.

Durieux-Smith, A., Delicati, D., Brewster, L., Fitzpatrick, E., & Phillips, A. (1995). CASLPA Position Paper on cochlear implants in children. *Journal of Speech-language Pathology and Audiology, 19*(3), 147-153.

Fitzpatrick, E., & Brewster, L. (2008). Pediatric cochlear implantation in Canada: Results of a survey. *Canadian Journal of Speech-Language Pathology and Audiology, 32*(1), 29-35.

Haensel, J., Ilgner, J., Chen, Y.-S., Thuermer, C., & Westhofen, M. (2005). Speech perception in elderly patients following cochlear implantation. *Acta Oto-Laryngologica, 125*, 1272-1276.

Maessen, H., & Schramm, D. (2009). Survey of practice variations among Canadian cochlear implant centres. Paper presented at the 12th Symposium of Cochlear Implants in Children, Seattle, Washington.

Rosen, S. (1990). Cochlear implants: Some consensus at last? *British Journal of Audiology, 24*, 351-370.

Royal National Institute for Deaf People (2007). *Cochlear Implant Services Commissioning Guidelines*. Retrieved August 26, 2009, from http://www.rnid.org.uk/VirtualContent/91875/2742_cochlear_implant.pdf?from=/cochlearimplantservices/.

Rubinstein, J. T., Parkinson, A., Tyler, R. S., & Gantz, B. J. (1999). Residual speech recognition and cochlear implant performance effects of implantation criteria. *American Journal of Otology, 20*, 445-452.

Vermeire, K., Brokx, J. P. L., Wuyts, F. L., Cochet, E., Hofkens, A., & Van de Heyning, P. H. (2005). Quality-of-life benefit from cochlear implantation in the elderly. *Otology & Neurotology, 26*, 188-195.

Acknowledgements

We thank Natalie Moreau, Heather Maessen and Chistiane Séguin for their comments and assistance with developing and refining the questions for the survey. We appreciate assistance with questionnaire translation from Amy Geleyn. We are extremely grateful to the cochlear implant centres for taking the time to complete this questionnaire. Part of this information was presented at the Canadian Cochlear Implant Centres Meeting in Toronto, November, 2008. Support for preparation of this material is acknowledged from the Faculty of Health Sciences, University of Ottawa. E. Fitzpatrick also holds a Canadian Institutes of Health Research New Investigator award.

The editorial process of this manucript was overseen by Benoît Jutras.

Author's Note

Correspondence concerning this article should be addressed to Elizabeth Fitzpatrick, University of Ottawa, Faculty of Health Sciences, 451 Smyth Road, Room 3017, Ottawa, Ontario K1H 8M5. Email: efitzpat@uottawa.ca.

Received: October 2, 2009

Accepted: February 8, 2010