Telephone Consultations with Otolaryngology – Head and Neck Surgery (OHNS) Reduced Emergency Visits and Specialty Consultations in Northern Alberta: A Quality Assurance Study

by

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ABSTRACT

RAAPID (Referral, Access, Advice, Placement, Information, and Destination) is a 24-hour call center run by Alberta Health Services, Alberta, Canada. RAAPID facilitates urgent telephone consultations between Alberta's physicians with specialists in tertiary care centers, allowing many patients to be cared for in the community, avoiding emergency department (ED) visits and specialty consultations. This thesis consists of two parts: (1) an environmental scan of telephone consultation programs and (2) a quality assurance study of the extent to which RAAPID calls to Otolaryngology-Head and Neck Surgery (OHNS) reduced ED visits and specialty consultations.

Study 1. The environmental scan used a literature search and a google search to identify programs providing physician-to-physician telephone consultations. The searches yielded 17 publications for inclusion. The programs' characteristics were heterogeneous across a wide range of disciplines. Telephone consultation processes were mostly direct to the specialist or with a few utilizing an intermediary or a paging system, with access varying from several hours a week to 24-7. Only a few studies evaluated reduction of services like ED visits and specialist consultations.

Study 2. The quality assurance study evaluated the outcomes of telephone consultations to OHNS in 2013-2017. Of 1709 telephone consultations, 51.7% resulted in providing advice to the callers, reducing ED visits. A further 10.5% of calls resulted in a referral to a specialty clinic, increasing the proportion of calls reducing ED visits to 62.3%. The estimated direct costs avoided from ED visits was $156,618.08.

Conclusion. Telephone consultations facilitate access to specialty consults, allowing for patients to be cared for in the community. The RAAPID program's calls to OHNS have decreased potential visits to the ED or referrals to specialist clinics and their associated costs.

PREFACE

This paper-based thesis is an original work by Peter George Tian. It consists of two projects: (1) an environmental scan of programs providing telephone consultations between healthcare providers and (2) a quality assurance study on telephone consultations with Otolaryngology-Head and Neck Surgery.

The environmental scan (Chapter 2) didn't require ethics approval. This study received voluntary assistance from Thane Chambers (TC), a health sciences librarian in the University of Alberta, and Sara Alvarado, a Research Assistant in the Department of Family Medicine. This study will be submitted to the Canadian Journal of Public Health.

The quality assurance study (Chapter 3) received several approvals: (1) University of Alberta's Health Research Ethics Board (Study ID Pro00081649), (2) Alberta Health Services (Data Disclosure Agreement RA87657), and (3) Northern Alberta Clinical Trial and Research Centre (NACTRC) Edmonton Zone Administrative Approval for Project (PRJ # 35457). This study will be submitted to the Canadian Medical Association Journal.

DEDICATION

To my children,

Iggy and Tweet,

may education be one of your treasures,

as it is mine.

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LIST OF ABBREVIATIONS

E.D.	Emergency Department
OHNS	Otolaryngology – Head and Neck Surgery
R.A.A.P.I.D.	Referral, Access, Advice, Placement, Information, and Destination

CHAPTER 1. INTRODUCTION

1.1 BACKGROUND

Consultations between health care providers have used various communication and information technologies to bridge distance. This 2-way communication between 2 clinicians or between clinicians and patients has been referred to as teleconsultation.[1] A variety of equipment may be used ranging from telephones and faxes to videoconference equipment and laboratory monitors (e.g., for electrocardiography), through the internet, and other networks.[2] Teleconsultation between physicians has been used in numerous fields including surgery, medicine, dermatology, and psychiatry.[3] However, teleconsultation has also been widely used between patients and healthcare providers. In diabetes care, for example, videoconferencing, mobile telephone applications, and web-based management systems have been used to monitor and improve patient care directly.[4]

The use of teleconsultation between physicians is exemplified in teledermatology. It has been used between the primary care physician and the dermatologist or between a dermatologist and another dermatologist.[5] Several technologies are used. Store-and-forward teledermatology, the most common modality, allows the referring physician to store and send images and clinical data to the accepting dermatologist. Real-time teledermatology uses a live video connection for communication.[6] One or a combination of these technologies is most commonly used in teleconsultation. However, it has also be used for care or follow-up consults between patient and dermatologist. [6] Teledermatology has been shown to be reliable, with clinical outcomes similar to in-person care, with high satisfaction from both providers and patients.[6]

Teleconsultation is used worldwide. In the 2015 Global Survey on eHealth, the World Health Organization presents that more than half of its member states have an eHealth strategy.[7] eHealth has been defined as the use of information and communication technologies in support of health services. The report further states that 83% of countries report at least one initiative using mobile devices (e.g., mobile phones) for medical and public health practice. 62% of countries reported employing mobile technologies for consultations between healthcare providers or between providers and patients.[7]

Canada is one of the WHO countries using mobile technologies for consultations.8 In Ontario, a 24-7 call centre (CritiCall) facilitates urgent consultation between physicians.9 An email messaging system (eConsult) allows physicians and nurse practitioners to consult with specialists.10 Ontario also provides

virtual visits for patients over a secure online system via chat messaging, telephone or video.11 There is also a for-profit patient-to-physician teleconsultation service in Ontario. However, its uptake is noted to be slow. 14 British Columbia has a similar program. It's Rapid Access to Consultative Expertise allows primary care providers to access to about 300 specialists. 12 A pilot program (eCASE – electronic Consultative Access to Specialist Expertise) allows family physicians to send referrals through a web-based platform. 13 In Alberta, there are also similar teleconsultation programs. Physician-to-physician consultations can be accessed through the RAAPID (Referral, Access, Advice, Placement, Information & Destination) program. 15 Electronic consultations can also be done through eReferral.16 Beyond these specific examples, physician-to-physician telephone consultations are available across most of Canada: CritiCall in Ontario, RACE in British Columbia, Yukon, and Manitoba, Med-Response in the North West Territories, and Acute Care Access Line in Saskatchewan.

1.2 The RAAPID Program

RAAPID is a 24-hour call center run by Alberta Health Services, Alberta, Canada. It facilitates urgent telephone consultations between Alberta's physicians with specialists in tertiary care centers. This telephone consultation allows patients to be cared for in their own communities, referred to outpatient clinics, or dispatched to emergency departments when needed.[15] RAAPID has 2 arms, one for northern Alberta (RAAPID-North) and another for southern Alberta (RAAPID-South). [17]

The RAAPID referral process is started by a physician calling a hotline asking for a consult with another physician. A nurse then triages the call, arranges the telephone conference between the physicians, and executes the disposition.[18] In November 2014 to October 2015, a total of 51,171 referrals were arranged.[18] The top 5 specialist services accessed were emergency, cardiology, pediatric emergency, orthopedics, and general surgery. Of the referrals, 63% resulted to emergency department visits or direct admissions.[18] The remainder of the consultations resulted in provision of medical advice (29%), i.e., allowing the calling physician to care for the patient in their local practice, and referral to an outpatient specialist clinic (7%).

1.3 STATEMENT OF THE PROBLEM

Among RAAPID's telephone consultations are those to Otolaryngology – Head and Neck Surgery (OHNS), mainly in the University of Alberta Hospital, Edmonton, Alberta, Canada. Physicians in rural communities in Alberta dealing with serious airway infections, for example, may telephone RAAPID to be connected with on-call OHNS staff. Since two of the thesis committee members (JH and HS) are practicing OHNS specialists providing RAAPID consults, this thesis project focused on OHNS consults. This is a quality

assurance initiative to evaluate the outcomes of RAAPID-North's consults to OHNS, whether these consults reduced emergency department utilization, allowing patients to be cared for in their communities.

1.4 SUMMARY

Teleconsultation have allowed consultations across distance between physicians and between patients and physicians. Teleconsultation has been used globally and use various information and communication technologies. Almost all programs which have been evaluated have shown improvements in patient management and/or reduction in expensive healthcare services, such as ED visits. The use of telephones between healthcare providers is but a subset of teleconsultations used across Canada and the world but is a commonly used mode in most programs. In Alberta, RAAPID also uses telephone consultations as part of its eHealth approach. RAAPID provides access to a number of specialists, including telephone consultations with OHNS. To our knowledge, no program has described or evaluated the potential impact of telephone consultations to otolaryngologists, specifically, which is the focus of this thesis.

1.5 OBJECTIVES

There were two objectives from this program of research:

1) To determine the existing literature on telephone consultations as part of a teleconsultation modality to care;
2) An analysis of the outcomes of Alberta's RAAPID-North telephone consultations to OHNS.

The first objective was realized by conducting an environmental scan of literature and programs between 2007 and 2017. We identified and evaluated the literature to determine the key characteristics of programs currently being employed for physician-to-physician telephone consultations. This included country of program, description of program, who is the program available to, availability of service (e.g. days and times available, specialty areas), measures reported (i.e., volume of calls, response times, disposition after consultation (i.e., sent home, sent to ED/hospital, elective consultation in a speciality clinic), and potential costs or cost avoidance. These programs were also compared and contrasted to what is currently be employed within RAAPIDS services.

The second objective was accomplished through a quality assurance study of all telephone consultations with OHNS among RAAPID-North's calls in 2013-2017. We used quality assurance as defined in Alberta Health Services' Common Definitions within Health (Alberta Health Services, 2017): "Quality assurance is a planned or systematic activity with the purpose to study, assess, or evaluate the level of safety in the

provision of health services."[19] Among calls to RAAPID-North's OHNS, we determined the characteristics of the patients, time of call (i.e. office vs after hours), physician caller's site and distance to the University of Alberta Hospital which is the referring institution in 98% of calls received; response time of the OHNS staff to the page from RAAPID; time call was cleared, and disposition (i.e., action advised) after the telephone consultation. Our main outcome of interest was reduction of ED visits, reduction of need to attend an outpatient speciality clinic, and the total potential cost avoided through reduction of emergency department visits.

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CHAPTER 2. AN ENVIRONMENTAL SCAN OF PROGRAMS PROVIDING TELEPHONE CONSULTATIONS BETWEEN HEALTHCARE PROVIDERS

2.1. ABSTRACT

Objective: As part of a quality assurance study of a physician-to-physician consultation program in Alberta, this environmental scan aimed to identify the characteristics and outcomes of physician-to-physician telephone consultation programs.

Methods: We searched 7 databases to identify English publications in 2007-2017 describing physician to physician consultations using telephones as the main technology. To identify Canadian programs, the literature search was supplemented with an additional Google search.

Results: The literature search yield 2336 citations of which 15 publications were included. 13 telephone consultation programs across 6 countries provided primary care providers with access to various specialist through hotlines, paging system, or call centres. The programs reported on the avoidance of hospitalizations, emergency department visits, and specialty visits, satisfaction of the callers on the telephone consultation, and cost avoidance.

Conclusion: Telephone consultation programs between healthcare providers have facilitated access to specialist care and prevented acute care use.

2.2. INTRODUCTION

Health care systems are evolving to the point that in order to be considered an efficient health system information must be rapidly collected, stored, analysed and made increasing accessible in real time to a wide range of healthcare providers to optimize patients care. A key component of these systems is the use of technology to allow healthcare providers to easily consult and securely share patient information with other providers. The World Health Organization (WHO) promotes this use of information communication technology (called eHealth) in support of health care services and training. In a 2016 survey, WHO reported that 58% of responding members states had eHealth strategies and 62% of member states had a consultation service using mobile information communication technology between healthcare practitioners or between healthcare practitioners and patients.[1]

This ubiquitous use of technology in healthcare is reflected in published literature and the benefits of these systems to processes of care have been well documented. A systematic review by Deldar et al. found 174 publications which have examined the role of teleconsultations.[2] Another systematic review by Saliba et al. identified 94 studies evaluating the facilitators and barriers of various telemedicine services.[3] The delivery of such eHealth solutions is substantial. Teleconsultations in dermatology[4] and psychiatry[5] , for example, may come in different modalities and be provided using videoconferencing and store-and-forward systems (sending images and text information). Teleradiology which has been around for decades has allowed the transmission, storage, and retrieval of images between radiologists and other professionals (Bashur, 2016).[6] Many other technologies may be used as accessible electronic medical records, mobile telephone symptom recording, and dedicated support lines, as used in palliative care.[7]

In Alberta, Canada, physicians have access to telephone consultations with specialists through a 24-7 call center called R.A.A.P.I.D. (Referral, Access, Advice, Placement, Information and Destination). RAAPID ensures that physicians have quick access to other physicians, often specialists, for advice, allowing patients to be cared for by the calling physician in their local setting. However, if patients require transfer to other institutions for care, RAAPID also facilitates these transfers.[8] One component of the RAAPID system that has been increasingly being utilized are telephone consultations with OHNS. As part of a quality assurance study to evaluate RAAPID's telephone consults with OHNS, we conducted an environmental scan of similar programs, searching for program characteristics and outcomes associated with similar physician-to-physician telephone consultations programs.

2.3. METHODS

We used a combination of formal literature searches and google searches based on methods adapted for the conduct of an environmental scan (Diouf, 2016).[9] Other published environmental scans have also used google searches in gathering data (Portocarrero, 2015; Griffith, 2012).[10-11] Since the RAAPID program provides consultation using only phones between physicians, we limited our search to programs which included physician-to-physician consultations, with telephone as the main technology.

An information technologist (TC) performed the literature search. The search was done on the following databases: Ovid MEDLINE(R), Embase, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, NHS Economic Evaluation Database, CINAHL, and Web of Science Core Collection. The search was limited to publications in the English language and to a 10-year range, 2007-2017 to ensure any identified articles reflected more contemporary practice in the field. To identify Canadian programs, the literature search was supplemented with an additional Google search (by PT) using the following search terms: (Physician or Doctor) AND (Telephone Consultation or Phone Consultation). Potentially relevant search results and websites were then reviewed. The search results in google were limited to the first 10 pages of the search results (~100 results).

Three authors (PT, TC, SA) screened the search results for programs providing access to specialists through telephone consultations. For the results from the literature search, a two-step screening was done: title-abstract screening and full-text review to identify relevant studies. Titles and abstract were screened independently by two of three authors (PT, TC, SA). Full-text screening was then independently reviewed by two authors (PT, SA). Disagreements in the screening decisions were resolved by discussion. Only programs using consultations by telephones as the main technology were included. We excluded telephone consultations used in combination with other technologies (i.e., fax, video platform, electronic communication, mobile messaging, and web-based platforms).

One author (PT) extracted the data and data was verified by a second author (SA). The following data were extracted from the publications and from the google search results: Name of program, country of program, description of program, who is the program available to, availability of service (e.g. days and times available, specialty areas), measures reported (i.e., volume of calls, response times, disposition after consultation (i.e., sent home, sent to emergency department/hospital, elective consultation in a speciality clinic), satisfaction with the calls, and potential costs or cost avoidance. For the supplemental google search, one author (PT) reviewed the search results and extracted the data.

2.4. RESULTS

The literature search yielded 2336 citations of which 17 publications were identified and included (Figure 1).

The seventeen publications described 14 telephone consultation programs, 4 programs in the United States, 3 programs each in Canada and France, and one each in Australia, Netherlands, United Kingdom, and Italy (Table 1). The sample size of the included consultations reported ranged from 19 to 4436. In addition to these publications, the google search yielded 17 webpages linked to 13 Canadian telephone consultation programs (Table 2).

Telephone consultation process. The process starts with the provision of a telephone line. Some publications used the term hotline; however, since there were no reported definitions of a hotline differentiating it from a regular telephone line, we extracted the terms as published. 10 studies reported a program where the call connects directly and is answered directly by the specialist.[12-21] Four studies indicated the call is answered by an intermediary who then routes the call to the specialist.[22-25] Finally, 2 studies indicated the call is routed to a specialist's pager or a mobile messaging service with the specialist calling physician (Figure 2).[26-27]

Accessibility. The accessibility of telephone consultations varied. Some were available 24 hours a day, 7 days of the week.[12,15] Others were only available during business hours or extended business hours, Mondays through Fridays.[13,16,22,26-27] One program was limited to an hour a day, 5 days a week.[14]

Response time between the programs also varied. Wilson (2016) reported that 78% of calls were responded within 10 minutes.[27] Lear (2010) reported that 81.4% of calls returned within one hour or less.[26] These two studies used a system where providers paged specialists who in turn called the former. Marquet (2013) reported that 19.8% of calls were answered immediately.[28]

Callers. Most of the programs were geared towards family physicians, general practitioners, or primary care providers.[12-15,19,24,26-27] In addition to physician callers, some programs also had non-physician callers: nurse practitioners, pharmacists, and other professionals.[15-16,27-29] Other programs were highly restricted like the Massachusetts Child Psychiatry Access which was limited to pediatric primary care clinicians including pediatricians and nurse practitioners in addition to family physicians.[21-23,29]

Specialists Called. The different programs offered consults to different specialties. The Rapid Access to Consultative Expertise in British Columbia offered a wide number of specialists.[27] However, the majority of the studies reported consults only to certain physician specialists: psychiatrists,[14,22] infectious disease specialist,[12,28] geriatricians,[13] pediatricians,[17,22] and cardiologists.[24,26] One reported access to general practitioners who served as advisers.[15] Others provided access to non-physician members of the team: pharmacist, psychotherapist, care coordinator.[16,22]

Patent Disposition – Only 6 (40%) of the 15 publications assessed any type of disposition within the program. With respect to patient/medical advice, only 1 publication explicitly noted this feature. Salles (2014) reported that 38.3% resulted in advice.[13] Although Hobbs (2014) did not report this, the article cited a publication which reported that in the Massachusetts Child Psychiatry Access 24% of consults resulted in the primary care clinicians maintaining primary care responsibility.[22,29] Several publications noted that additional consultation occurred as a result of the call. Lear (2010) reported that 17.8% resulted in further consultation with the cardiologist.[26] Marquet (2013) reported that 6% led to infectious disease consultation.[28] Salles reported that 5.3% resulted in geriatric consultation.[13] Wegner (2008) reported that 32% avoided pediatric subspecialists' visits.[17] Wilson (2016) reported that 60% prevented a face-to-face consultation.[27] Several publications (5/15, 33%) assessed emergency department (ED) or hospitalizations as an outcome of the program.[13,17,24,27-28] However, the studies differed in how the patient dispositions were reported. Zanaboni (2009) reported that 8% resulted in ED visits or hospitalization.[24] Marquet (2013) reported that 5.5% led to hospitalization.[28] Salles (2014) reported that 9.2% resulted in day hospital visit, 42.9% in hospitalization in geriatrics ward, and 4.3% in direct ED admission.[13] Conversely, several publications noted large effects with respect to avoidance of ED visits or hospitalizations. Indeed, Zanaboni (2009) reported that 77% of calls avoided ED visits or hospitalizations.[24] Wilson (2016) reported that 32% avoided ED visits[27] while Wegner (2008) reported that 5% avoided ED visits and 5% avoided hospital admissions.[17]

Cost Avoidance. Cost avoidance from the telephone consultations was reported in three of 15 publications (20%) and varied depending on how the studies determined cost avoidance. Wegner (2008) reported a cost savings of $477,274 for 306 consults over 8 months.[17] However, this costing not only included the cost for subspecialist visits and telephone consults but also included avoidance of potential hospitalization cost. Wilson (2016) reported a cost savings of $9,005 for 148 calls.[27] Zanaboni (2009) reported a direct savings for in-clinic visits of €20,472 for 927 calls.[24]

Satisfaction with Calls. Nine of 15 publications determined the satisfaction after the telephone consultations. Physicians rated the telephone consultations positively, ranging from 80-100%.[12,24,26] The ratings were in terms of satisfaction with the specialist's recommendations, issues addressed adequately, improved confidence in managing the patients. Also, compliance to recommendations were rated high, ranging from 90-93%. [12,15,24]

2.5. DISCUSSION

Our environmental scan identified 17 studies in the area of telephone consultation along with 13 programs across Canada. Programs were widely dispersed across a wide range of specialties and disease states. Overall the most common model for accessing care was having the physician connect directly with the specialist/consultant as opposed to using a routing system or call-back procedure. Although the majority of programs were to physicians, many were supportive of calls from other members of the care team.

Interestingly, only less than half of the publications evaluated outcomes related to patients' dispositions or costs. In the few studies that evaluated healthcare utilization, all reported an avoidance in either emergency department visits or hospitalizations. As expected, this translated into major cost-savings for the programs when evaluated. However, it is relatively unclear what the overall net savings/costs of these programs were as few, if any, analyses accounted for the input costs of operating and maintaining these programs. Indeed, British Columbia's RACE program[27] has a low operating cost. It provides a hotline system that directly pages a specialist, who in turn calls the referring physician. RACE reports a cost of only $120/month for the telephone system support and an administrative support cost for 1 day per month. Although costs savings, or at a worst case, some costs occurrence to the system would be expected, the benefits to patients in terms of timely medical advice and in indirect costs to patients (e.g., travel to emergency department, time away from work, etc.) would likely offset any cost occurrences. Coupled with reduced pressure on the ED and hospital system reported by the programs, the benefits are likely substantial.

In relation to other programs, RAAPID's 24-7 call centre shares some similarities but also notable differences. Unlike the major of program that involved direct calling to the specialists, physicians call a hotline and the call centre will connect them to specialists, if needed. The call centre provides extensive support. At the consultation level, the call centre triages the call to specialists, ascertains that the consultations occur, and provides logistical support during and after the consultation. At a system level, the call centre, when required, coordinates the transfer of patients to appropriate centres, with due

consideration to bed management. This labor-intensive process, however, will impact the operating cost (i.e., cost from 24-7 staffing).

Although more expensive to implement, the RAAPID program has previously reported that from November 2014 to October 2015, out of 51,171 telephone consultations, 36% were not referred to the ED (29.1% resulted in the provision of advice and 6.9% were referred to a specialist clinic).[30] This coincides with the figures observed from other programs reported here. British Columbia's RACE reported a 32% prevention in ED visits[27]; Wegner's study (2008) to pediatric subspecialists reported that 52% avoided ED visits, specialty visits and hospital transfers and admissions[17] while Zanaboni's study (2009) for calls to cardiology, dermatology and diabetology reported that 77% avoided ED visits, hospitalizations, or in-clinic consults.[24]

This environmental scan is the first narrative review of the telephone consultation programs. We've reviewed the published literature and with a supplemental google search. However, the heterogeneity of programs and outcome measures limited the comparison across programs. Moreover, limitations in resources have precluded a systematic review and a more extensive review of google searches. The pervasive use of technology in healthcare consultations was evident in the literature search and google searches where the use of phones for consultations was minority compared to the use of more recent technology as videoconferencing, mobile messaging, and other electronic and web-based platforms.

2.6. CONCLUSION

Telephone consultation programs between healthcare providers have facilitated access to specialists. The programs have allowed primary care providers to retain the care for their patients and avoided acute care use. These telephone consultation programs, along with newer technologies, have increased the efficiency of healthcare.

2.7. REFERENCES

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Figure 1. Flow chart of literature review process.

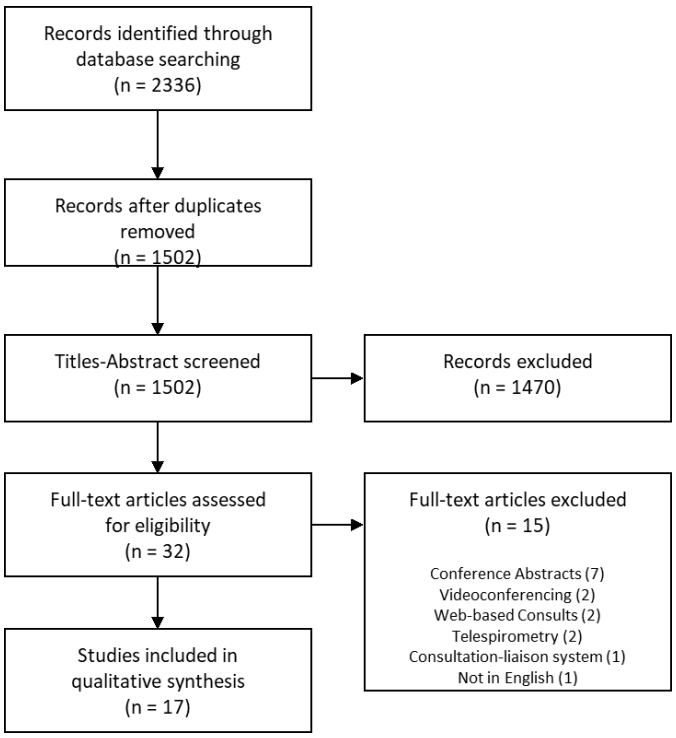

Figure 2. Various telephone consultation processes.

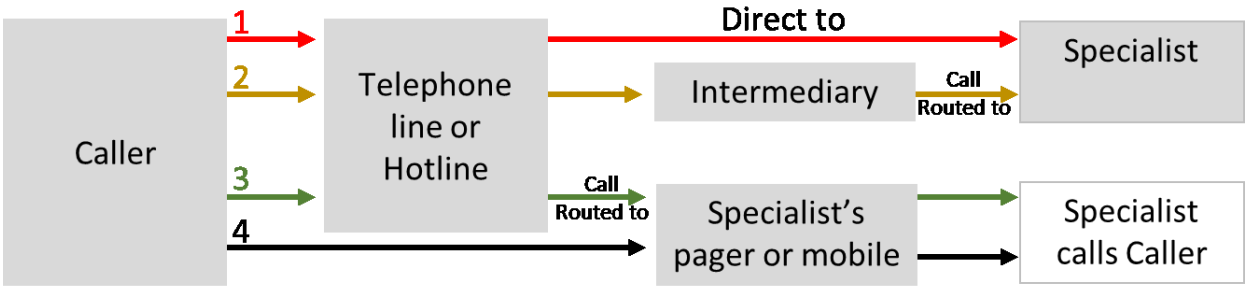

Table 1. Characteristics of telephone consultation programs.

1st Author, publication year, country	Program name and description	Access	Consultation sought by	Consultation provided by; (# of Calls; duration)	Patient disposition after the call
Bal, 2011, France	Hotline on a dedicated cellular telephone	24-7 service	GPs	Infectious Disease Resident & Specialist; (284 calls in 6 months)	NR
Clark, 2015, Canada,	Randomized trial comparing usual care with telephone consult	NR	Primary care physicians	Pain specialist at 0 months, 3 months and 6 months; (n= 41)	NR
Hilt, 2013, USA Hilt	The Partnership Access Line; Toll-free number	8AM-5PM, Monday to Friday	Primary care provider	Child and adolescent psychiatrist (2285 calls in 37 months)	NR
Hobbs, 2014, USA Sarvet, 2011, USA Sarvet 2010, USA Straus, 2014, USA	Massachusetts Child Psychiatry Access; Hotline (answered by the Care Coordinator and routed to appropriate team member)	Business hours, Monday to Friday	Pediatric primary care clinicians (pediatricians; family practice physicians; nurse practitioners)	Child Psychiatrist, Family Psychotherapist, Care Coordinator (4436 calls in 1 year)	NR 24% of 8223 consults resulted in the primary care clinicians maintaining primary clinical responsibility.
Lear, 2010, Canada	Rapid Access to Cardiology Expertise (pilot project to Wilson 2016 below); Paging system which initiates a call.	Business day	Family physicians (The physicians page the cardiologist.)	Cardiologists (118 calls over 7 month; the cardiologist calls the paging family physician)	*17.8% resulted in further consultation with the cardiologist.
Linklater, 2009, UK	Telephone advice line	24-7	Primary care clinicians (GPs, Hospital doctors, Hospital/community nurses, patient/carer)	Consultant or specialist registrar in palliative medicine (1146 calls over 6 years & 1 month)	NR
Marquet, 2013, France	National network of infectious disease experts	NR	Community and healthcare professionals	Infectious disease specialists (323 calls in 5 days)	*6% led to infectious disease consultation; *5.5% led to hospitalizations;
Salles, 2014, France	Hotline	9AM-7PM, Mon-Fri	GPs	Geriatricians; (714 calls in 16 months)	*38.3% resulted in advice. *5.3% resulted in Geriatric consultation. *9.2% resulted in Day hospital visit. *42.9% resulted in hospitalization in geriatrics ward. *4.3% resulted in direct admission to ED.
Sankaranarayanan, 2010, Australia	Telephone line	1200-1300H, Mon-Fri	GPs	Psychiatrist; (19 discussions in 3 mos)	NR
van Heest, 2008, Netherlands	Telephone line	24-7	GPs, nurses, pharmacists, other healthcare providers	General Practitioner Advisers in palliative care on treating nausea and vomiting; (572 consultations in 1 year)	NR
Waldura, 2013, USA	HIV Warmline	9AM-8PM	Primary care clinicians (Physicians, other healthcare providers)	HIV specialists (physicians/pharmacists)	NR
Wegner, 2008, USA	Telephone line	NR	Primary care physicians	Pediatric subspecialists; (306 consults in 8 months)	*32% avoided PS visits. *11% avoided hospital transfers. *5% avoided hospital admissions. *5% avoided ED visits.
Wilson, 2016, Canada	Rapid Access to Consultative Expertise; Hotline that automatically routes to a specialist's pager/mobile #	8 AM - 5 PM, weekdays	Family physicians or nurse practitioners	Various Specialists; (A subset of 2000 calls in 2 years)	*60% prevented a face-to-face consultation. *32% prevented emergency department visit.
Zanaboni, 2009, Italy	Telephone calls routed through a service center; with invited to use biomedical devices	NR	GPs	Cardiologists, dermatologists, diabetologists (927 cardiology calls; in 25 months)	*8% resulted in ED visits or hospitalization. *1% resulted in In-Clinic visits. *Comparing consultants' decisions with GP's decisions: Avoided ED visit, hospitalization or in-clinic consult=77%

Legend: GP, General Practitioner; NR, Not Reported.

Note: The terms hotline and warmline are listed here as used in the respective publications.

Table 2. Characteristics of Canadian telephone consultation programs (from the Google search).

Name	Province	Program Description	Caller	Call Received by
Cancer Line	Alberta	Assist with cancer-related questions	Physicians and healthcare providers	Medical or radiation oncologist; expert oncology nurse;
Orthopedic Consult Line	Alberta (Edmonton)	NR	NR	NR
PaedLink Telephone Consultation Service*	Alberta (Calgary)	8AM-8PM, Mon-Sun; single access number	NR	NR
RAAPID	Alberta	Hotline; 24-7	Physicians	Multiple specialists
Specialist LINK*	Alberta (Calgary)	Telephone advice for non-urgent cases; 8AM to 5 PM, Monday to Friday, except statutory holidays	Physicians and nurse practitioners; midwives to pediatricians	Multiple specialists
Rapid Access to Consultative Expertise	British Columbia; Yukon	8AM-5PM; Monday to Friday	Physician; nurse practitioner	Multiple specialists
Rapid Access to Consultative Expertise	Manitoba	NR	NR	NR
Med-Response	North West Territories	NR	NR	NR
CritiCall-Ontario	Ontario	NR	NR	NR
Ontario Shores	Ontario	Telephone advice; Online booking	Family physicians or nurse practitioners	Psychiatrist
Leveraging Immediate Non-urgent Knowledge (LINK)	Saskatchewan	Physician-to-physician telephone consultation service for non-urgent conditions; 8AM-5PM Monday to Friday	NR	Multiple specialists;
Acute Care Access Line (ACAL)	Saskatchewan	Urgent calls; Complementary to LINK service	NR	NR
Bedline	Saskatchewan	NR	NR	NR

*Eligible for CME credits
Legend: NR, Not Reported.

APPENDIX A. LITERATURE SEARCH RESULTS AND STRATEGIES

Platform	Database	# of results	Date of search
Ovid	Ovid MEDLINE(R) Epub Ahead of Print September 26, 2017	8	27 Sept 2017
	Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations September 26, 2017	50	27 Sept 2017
	Ovid MEDLINE(R) 1946 to September Week 2 2017	858	27 Sept 2017
	Embase 1974 to 2017 September 29	795	2 October
Wiley	Cochrane Database of Systematic Reviews : Issue 9 of 12, September 2017	3	29 Sept 2017
	Cochrane Central Register of Controlled Trials : Issue 9 of 12, September 2017	122	
	NHS Economic Evaluation Database : Issue 2 of 4, April 2015	3	
EBSCOhost	cinahl	244	27 Sept 2017
Web of Science	Web of Science Core Collection	253	27 Sept 2017
	Total	2336	
	Duplicates in EndNote Library	832	

MEDLINE 1946-, Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily

1. exp Telemedicine/

2. "referral and consultation"/ or remote consultation/

3. telephone/ or tele*.mp.

4. 2 and 3

5. ((tele* adj5 (consult* or advice)) or teleconsult* or telemedicine or tele-medicine or telecardiology or tele-cardiology or teledermatology tele-dermatology or telediagnosis or tele-diagnosis or telepathology or tele-pathology or telepsychiatry or tele-psychiatry or teleradiology or tele-radiology or teleradiotherapy or teler-adiotherapy or telesurgery or tele-surgery or teletherapy or tele-therapy).mp.

6. 1 or 4 or 5

7. general practice/ or family practice/

8. Physicians, Family/ or General Practitioners/

9. primary health care/ or "continuity of patient care"/

10. (((primary or family or general) adj3 (care or physician* or doctor* or practitioner*)) or ((family or general) adj practice)).mp.

11. or/7-10

12. allergists/ or anesthesiologists/ or cardiologists/ or dermatologists/ or endocrinologists/ or gastroenterologists/ or geriatricians/ or nephrologists/ or neurologists/ or occupational health

physicians/ or exp oncologists/ or ophthalmologists/ or osteopathic physicians/ or otolaryngologists/ or pathologists/ or exp pediatricians/ or pulmonologists/ or exp radiologists/ or rheumatologists/ or exp surgeons/ or urologists/

13. "allergy and immunology"/ or anesthesiology/ or bariatric medicine/ or behavioral medicine/ or dermatology/ or exp emergency medicine/ or geriatrics/ or exp internal medicine/ or exp neurology/ or osteopathic medicine/ or palliative medicine/ or pediatrics/ or exp "physical and rehabilitation medicine"/ or exp psychiatry/ or exp radiology/ or exp reproductive medicine/ or exp specialties, surgical/ or tropical medicine/

14. specialist*.mp.

15. or/12-14

16. 6 and 11 and 15

17. ("physician* physician*" or "doctor* doctor*" or interpractitioner* or inter practitioner*).mp.

18. 6 and 17

19. 16 or 18

Embase

1. *exp Telemedicine/ or *teleconsultation/

2. *consultation/

3. telephone/ or tele*.tw,kw.

4. 2 and 3

5. ((tele* adj5 (consult* or advice)) or teleconsult* or telemedicine or tele-medicine or telecardiology or tele-cardiology or teledermatology tele-dermatology or telediagnosis or tele-diagnosis or telepathology or tele-pathology or telepsychiatry or tele-psychiatry or teleradiology or tele-radiology or teleradiotherapy or teler-adiotherapy or telesurgery or tele-surgery or teletherapy or tele-therapy).tw,kw.

6. 1 or 4 or 5

7. general practice/

8. general practitioner/ or general practitioner/ or primary health care/ or primary medical care/

9. (((primary or family or general) adj3 (care or physician* or doctor* or practitioner*)) or ((family or general) adj practice)).tw,kw.

10. or/7-9

11. medical specialist/ or anesthesiologist/ or cardiologist/ or dermatologist/ or emergency physician/ or endocrinologist/ or gastroenterologist/ or geriatrician/ or gynecologist/ or hematologist/ or

immunologist/ or intensivist/ or internist/ or neonatologist/ or nephrologist/ or neurologist/ or obstetrician/ or occupational physician/ or exp oncologist/ or ophthalmologist/ or orthopedic specialist/ or osteopathic physician/ or otolaryngologist/ or pathologist/ or pediatrician/ or physiatrist/ or podiatrist/ or psychiatrist/ or pulmonologist/ or exp radiologist/ or rheumatologist/ or exp surgeon/ or urologist/

12. specialist*.mp.

13. 11 or 12

14. 6 and 10 and 13

15. ("physician* physician*" or "doctor* doctor*" or interpractitioner* or inter practitioner*).tw,kw.

16. 6 and 15

17. 14 or 16

Cochrane Database of Systematic Reviews : Issue 9 of 12, September 2017

Cochrane Central Register of Controlled Trials : Issue 9 of 12, September 2017

NHS Economic Evaluation Database : Issue 2 of 4, April 2015

#1 [mh telemedicine]

#2 [mh ^"referral and consultation"] or [mh ^"remote consultation"]

#3 [mh ^telephone] or tele*:ti,ab,kw

#4 #2 and #3

#5 (tele* near/5 consult*):ti,ab,kw or (tele* near/5 advice):ti,ab,kw or (teleconsult* or telemedicine or "tele medicine" or telecardiology or "tele cardiology" or teledermatology or "tele dermatology" or telediagnosis or "tele diagnosis" or telepathology or "tele-pathology" or telepsychiatry or "tele-psychiatry" or teleradiology or "tele radiology" or telesurgery or "tele-surgery" or teletherapy or "tele-therapy"):ti,ab,kw

#6 #1 or #4 or #5

#7 [mh ^"general practice"] or [mh ^"family practice"] or [mh ^"Physicians, Family"] or [mh ^"General Practitioners"] or [mh ^"primary health care"] or [mh ^"continuity of patient care"]

#8 (primary near/3 care):ti,ab,kw or (primary near/3 physician*):ti,ab,kw or (primary near/3 doctor*):ti,ab,kw or (primary near/3 practitioner*):ti,ab,kw or (family near/3 care):ti,ab,kw or (family near/3 physician*):ti,ab,kw or (family near/3 doctor*):ti,ab,kw or (family near/3 practitioner*):ti,ab,kw or (general near/3 care):ti,ab,kw or (general near/3 physician*):ti,ab,kw or (general near/3 doctor*):ti,ab,kw or (general near/3 practitioner*):ti,ab,kw or ("family practice" or "general practice"):ti,ab,kw

#9 #7 or #8

#10 [mh ^allergists] or [mh ^anesthesiologists] or [mh ^cardiologists] or [mh ^dermatologists] or [mh ^endocrinologists] or [mh ^gastroenterologists] or [mh ^geriatricians] or [mh ^nephrologists] or [mh ^neurologists] or [mh ^"occupational health physicians"] or [mh ^ophthalmologists] or [mh ^"osteopathic

physicians"] or [mh ^otolaryngologists] or [mh ^pathologists] or [mh ^pulmonologists] or [mh ^rheumatologists] or [mh ^urologists] or [mh oncologists] or [mh pediatricians] or [mh radiologists] or [mh surgeons]

#11 [mh ^"allergy and immunology"] or [mh ^anesthesiology] or [mh ^"bariatric medicine"] or [mh ^"behavioral medicine"] or [mh ^dermatology] or [mh ^geriatrics] or [mh ^"osteopathic medicine"] or [mh ^"palliative medicine"] or [mh ^pediatrics] or [mh ^"tropical medicine"] or [mh "emergency medicine"] or [mh "internal medicine"] or [mh neurology] or [mh "physical and rehabilitation medicine"] or [mh psychiatry] or [mh radiology] or [mh "reproductive medicine"] or [mh "specialties, surgical"]

#12 specialist*:ti,ab,kw

#13 #10 or #11 or #12

#14 #6 and #9 and #13

#15 ("physician* physician*" or "doctor* doctor*" or interpractitioner* or inter practitioner*):ti,ab,kw

#16 #15 and #6

#17 #14 or #16

CINAHL

S1 (MH "Telemedicine+")

S2 (MH "Referral and Consultation") AND (MH "Telephone")

S3 tele* N5 consult* OR tele* N5 advice OR teleconsult* OR (telemedicine or

"tele-medicine") OR (telecardiology or "tele cardiology") OR (teledermatology OR "tele-dermatology") OR (telediagnosis or "tele-diagnosis") OR (telepathology or "tele-pathology") OR (telepsychiatry or "tele-psychiatry") OR (teleradiology or "tele-radiology") OR (teleradiotherapy or "tele-radiotherapy") OR (telesurgery or "tele-surgery" or teletherapy or "tele therapy")

S4 S1 OR S2 OR S3

S5 (MH "Family Practice") OR (MH "Primary Health Care") OR (MH "Physicians, Family")

S6 (primary N3 (care or physician* or doctor* or practitioner*)) OR (famiy N3 (care or

physician* or doctor* or practitioner*)) OR (general N3 (care or physician* or doctor* or practitioner*))

S7 S5 OR S6

S8 (MH "Allergists") OR (MH "Anesthesiologists") OR (MH "Cardiologists") OR (MH

"Dermatologists") OR (MH "Endocrinologists") OR (MH "Gastroenterologists") OR (MH "Geriatricians") OR (MH "Neonatologists") OR (MH "Nephrologists") OR (MH "Neurologists") OR (MH "Oncologists") OR (MH "Ophthalmologists") OR (MH "Optometrists") OR (MH "Otolaryngologists") OR (MH "Pathologists+") OR (MH "Pediatricians") OR (MH "Physiatrists") OR (MH "Physicians, Emergency") OR (MH "Psychiatrists") OR (MH "Pulmonologists") OR (MH "Radiation Oncologists") OR (MH "Radiologists") OR (MH "Rheumatologists") OR (MH "Urologists") OR (MH "Surgeons")

S9 (MH "Specialties, Medical") OR (MH "Allergy and Immunology") OR (MH "Anesthesiology") OR (MH "Dermatology") OR (MH "Emergency Medicine") OR (MH "Hospital Medicine") OR (MH "Internal Medicine+") OR

(MH "Medicine, Environmental") OR (MH "Occupational Medicine") OR (MH "Pathology+") OR (MH "Pediatrics+") OR (MH "Specialties, Surgical+") OR (MH "Sports Medicine+")

S10 specialist*

S11 S8 OR S9 OR S10

S12 S4 AND S7 AND S11

S13 physician* N3 physician* OR doctor* N3 doctor* OR interpractitioner* OR "inter-practitioner*"

S14 S4 AND S13

S15 S12 OR S14

Web of Science

1 TS=(tele* NEAR/5 consult*) OR TS=(tele* NEAR/5 advice) OR TS=(teleconsult* OR telemedicine OR "tele medicine" OR telecardiology OR "tele cardiology" OR teledermatology OR "tele dermatology" OR telediagnosis OR "tele diagnosis" OR telepathology OR "tele pathology" OR telepsychiatry OR "tele psychiatry" OR teleradiology OR "tele radiology" OR teleradiotherapy OR "tele radiotherapy" OR teletherapy OR "tele therapy")

2 TS=("primary care" OR "family practice" OR "general practice") OR TS=(primary NEAR/3 physician*) OR TS=(primary NEAR/3 doctor*) OR TS=(primary NEAR/3 practitioner*)

#3 TS=(specialist*)

4 #3 AND #2 AND #1

5 TS=("physician to physician" OR "doctor to doctor")

6 TS=("physician physician" OR "doctor doctor")

7 #6 OR #5

8 #7 AND #1

#9 #8 OR #4

CHAPTER 3. TELEPHONE CONSULTATIONS WITH OTOLARYNGOLOGY – HEAD AND NECK SURGERY REDUCED EMERGENCY VISITS AND SPECIALTY CONSULTATIONS IN NORTHERN ALBERTA

3.1. ABSTRACT

Background. RAAPID (Referral, Access, Advice, Placement, Information, and Destination) is a 24-hour call center in Alberta, Canada, facilitating urgent telephone consultations between physicians and specialists. We evaluated the extent to which RAAPID calls to Otolaryngology-Head and Neck Surgery (OHNS) reduced visits to the emergency department and specialty clinics.

Methods. All telephone consultations to OHNS from physicians in northern Alberta between 2013-2014 (T1) (where consultations by residents occurred) and 2015 to 2017 (T2) (where consultations were done by consultants during office hours and residents during after hours) were evaluated. Outcomes of the calls included medical advice, specialty clinic referrals, and emergency department (ED) referrals. Differences in the reduction of ED visits and costs, overall as well as in T1 and T2 were assessed using multivariate logistic regression.

Results. Overall, 62.3% (1064/1709) of telephone consultations reduced ED visits consisting of advice being provided (n=884; 83.1%) and referral to specialty clinics (n=180; 16.9%). The adjusted odds ratio of calls reducing emergency visits in T2 as compared to T1 was 2.47 (95% CI 1.99 to 3.08). The adjusted odds ratio of reducing ED visits during office hours compared to after-hours 2.54 (95% CI 1.77-3.64). The estimated direct costs avoided from ED visits in T1 and T2 were $42,224.22 and $114,393.86, respectively.

Interpretation. RAAPID telephone consultations to OHNS were effective in reducing ED visits and healthcare costs. This model should be considered in other areas to improve efficiencies within the health system.

3.2. INTRODUCTION

Telephone consultations as part of an eHealth approach which allow healthcare providers to access specialists or specialty teams is increasingly be used in Canada. For example, R.A.C.E. (Rapid Access to Consultative Expertise) is a telephone hotline for family physicians and nurse practitioners in Vancouver, British Columbia, Canada. It reported that 32% of calls avoided an emergency department (ED) visit and 60% of calls avoided the need for specialist visits. These outcomes translated to an estimated of up to $200 of cost avoidance per call.[1] Other Canadian provinces have their own versions of telephone consultations. However, the programs' outcomes have not been reported. In the U.S., numerous programs also exist. For example, the Massachusetts Child Psychiatry Access provides a hotline to pediatric primary care clinicians for consults to a child psychiatry team.[2] It reported that 24% of consults resulted in the primary care clinicians retaining care for the patients. In Italy, a service to access cardiologists, dermatologists, and diabetologists was provided to general practitioners. This resulted in the avoidance of ED visits, hospitalizations, or in-clinic consultations in 77% of calls.[3]

Alberta, Canada has its own program called RAAPID (Referral, Access, Advice, Placement, Information, and Destination) which is a 24-hour call center. RAAPID facilitates urgent telephone consultations between Alberta's physicians with specialists in tertiary care centers. This telephone consultation allows patients to be cared for in their own communities, referred to outpatient clinics, or dispatched to emergency departments (ED) when needed. Among RAAPID's telephone consultations are those to Otolaryngology – Head and Neck Surgery (OHNS), mainly in the University of Alberta Hospital, Edmonton, Alberta, Canada. Physicians in rural communities dealing with serious airway infections, for example, may call RAAPID to be connected with on-call OHNS staff for medical advice. Whether this service is effective in reducing ED visits is unclear. Thus, we aimed to evaluate whether RAAPID-North's calls to OHNS between 2013-2017 reduced visits to the ED, specialty clinics, and healthcare costs.

3.3. METHODS

Between 2013 to 2017, all calls to OHNS in the RAAPID-North Program were evaluated. The RAAPID-North call centre facilitates all physician callers north of the city of Red Deer (Alberta, Canada) which is located between Alberta's two major urban centres (Edmonton and Calgary). Briefly, the telephone consultation process is started when the referring physician calls the 24-hour RAAPID call centre. A nurse receives and triages the call, pages the OHNS staff to arrange a teleconference between the physicians, and receives and executes the disposition.[4] Following each call, detailed information is

entered into an administrative database to document the service and includes: date and time of call; patient age and sex; physician caller's site; receiving physician's specialty and site (the University of Alberta Hospital in 98% of calls); response time of the OHNS staff to the page from RAAPID; time call was cleared, defined as the time elapsed when the call was received by RAAPID to the time the consultation was completed; and, disposition (i.e., action advised) after the telephone consultation. See Figure 1 below.

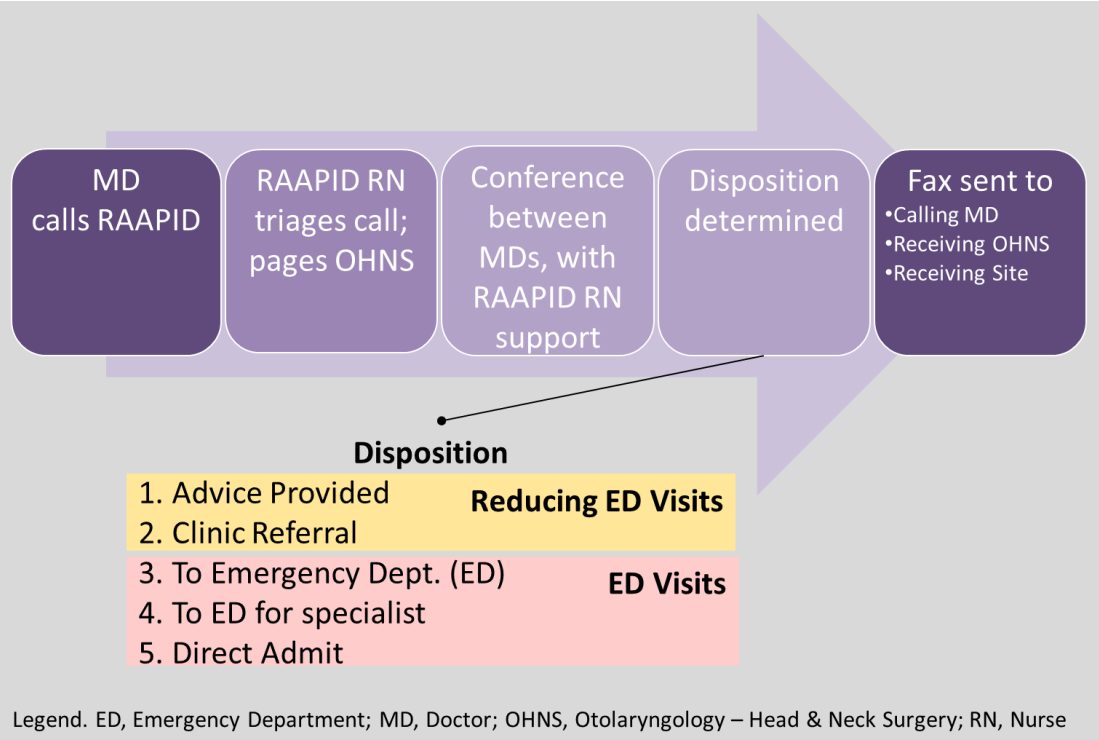

Figure 1. The RAAPID Referral Process.
Figure adapted and modified from: Montpetit J, Burke D, Carlson K. DTN – Interfacing with RAAPID. Quality Improvement and Clinical Research – Alberta Stroke Program, University of Calgary, Calgary, AB. 2017 [cited 2017 Jul 28]. Available from: https://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjsmNa366zVAhUB0GMKHX0ABNcQFggmMAA&url=http://www.ucalgary.ca/quicr/files/quicr/dtn-raapid-presentation.pdf&usg=AFQjCNECOjcc9i-igAklEzqnhxC9Uc81TQ

Outcomes. Our main outcome of interest was reduction ED visits after the telephone consultations. Each RAAPID call received by a consultant or their resident is associated with a final disposition of one of the following: (1) medical advice only to physician caller, (2) referral to an outpatient specialist clinic, and (3) medical advice to proceed to the ED. A fourth category of 'other' is also documented, however, this category is undefined, and we excluded all calls with this disposition (n=11). Consultations resulting only in advice to the physician caller or advising referrals to an outpatient specialty clinic were classified as

consultations reducing ED visits. This classification is justified as the calling physicians have no other options available to assist in the management of their patients in the province. As a result, directing patients to an ED is the only avenue available to these patients to obtain the medical assessments/advice required in the absence of the RAAPID program. We categorized telephone consultations advising referrals to the ED department or advising direct admissions as consultations resulting in ED visits, irrespective of whether this actually occurred.

Statistical methods. Descriptive statistics were used to describe the characteristics of the patients and calls. To evaluate the overall impact of the RAAPID program, the entire time period between 2013 to 2017 was used. Second, we divided the period into two separate time frames of analysis: January 1, 2013 to December 31, 2014 (T1) and June 1, 2015 to May 31, 2017 (T2). The rationale for having two evaluation periods was the implementation of a procedural change in 2015. Before January 2015, RAAPID calls were initially taken by OHNS residents. However, in January 2015, a procedural change routed all office-hour (i.e., 0900H to 1659H Monday to Friday) RAAPID consults directly to the OHNS consultants while after-hour calls were still directed to residents. For analyses, we evaluated the outcomes of the two-time frames combined and also compared the outcomes before (T1) and after (T2) the procedural change overall, as well as for office hours and after-hour consultations. To allow sufficient time for the new procedures to be implemented in T2, a washout period of 5 months (Jan 1, 2015 to May 31, 2015) was used and excluded from all analyses as it is expected the program is less efficient as new procedures are implemented. Logistic regression was used to estimate the odds ratios of reducing ED visits between T1 and T2 after adjusting for the patients' sex and age.

With respect to cost avoidance, we defined cost avoidance as the estimated expense avoided from consultation fees and average ED visit cost in Alberta. The cost model assumed the following: (a) all the patients would have been referred to the ED had there been no RAAPID telephone consultations; (b) the calling physician would not bill an additional fee for the RAAPID call because he would have billed for the initial consultation of the patient; (c) the OHNS consultant called would bill for the RAAPID call; (d) the OHNS resident called would not bill for the RAAPID call as they do not receive service fees in Alberta; (e) additional costs from diagnostic and management procedures would remain equivalent had the RAAPID call not occurred. Indirect costs (e.g., patient travel, time off work, administrative cost of ED program and RAAPID program) were not included in the model because of lack of data. See Appendix 1 for the detailed costs estimates used for the cost avoidance analyses. This cost model underestimates

the costs avoided in the ED from additional fees associated with OHNS ED consult and incidental procedures (e.g., endoscopy).

This study received approval from the University of Alberta Human Research Ethics Board (ID No. Pro00081649) and Alberta Health Services (Project #35457). Stata version 15.1 SE (StataCorp, College Station, Texas) was used for all analyses.

3.4. RESULTS

Between 2013 to 2017, there were 1709 RAAPID calls to OHNS from the RAAPID-North program. There were 474 (27.7%) calls in T1 and 1235 (72.3%) calls in T2. This represented an increase of 261% from T1 to T2. Out of the total calls, 45.6% of calls occurred during office hours on weekdays, 29.5% during after-office hours on weekdays, and 24.9% during weekends (Table 1).

The average age of patients was 45.6 years (SD 21.9 years). The age of the patients ranged from 0-100 years with 73% (n=1249) of patients belonging to the 21-70 age categories. Patients in T1 had a slightly lower mean age than T2 (41.3 vs 47.2 years, $p<0.001$) (Table 1, Figure 2). Overall, 43.4% of patients were females, with no difference between T1 and T2 ($p=0.346$) (Table 1).

After receiving the page from RAAPID, average response time was 18.9 minutes (SD 34.6) for the specialist/resident and 50.4 minutes (SD: 72.5 min) to clear a call. Majority of calls (n= 1281, 75%) of calls were cleared within an hour and 90% (n=1546) within 2 hours. The time to response and time to clear during office hours was quicker than after hours in both T1 and T2 (Table 1).

As expected, 97.1% (1660/1709) of the callers were from Alberta, with the rest from Northwest Territories (n=39, 2.3%) of which the University of Alberta Hospital is a service facility, Saskatchewan (n=7, 0.4%), Nunavut (n=2, 0.1%), and British Columbia (n=1, 0.1%). 52% of calls came from sites within 50 kilometers to the University of Alberta Hospital while 38% of the calls were from sites farther than 100 kilometers (Table 2). Most of the physician callers (98.3%; 1680/1709) were connected to OHNS in the University of Alberta Hospital. The rest of the callers were routed to other facilities, mostly in Edmonton.

Table 1. Characteristics patients, calls, and callers by time frame.

	T1 (n=474) Mean (SD) or n (%)	T2 (n=1235) Mean (SD) or n (%)	Overall (n=1709) Mean (SD) or n (%)	P-value*
Patient Characteristics				
Age in years– Overall	41.3 (25.4)	47.2 (20.2)	45.6 (21.9)	<0.001
Sex - male	277 (58.4)	690 (55.9)	967 (56.6)	=0.529
Characteristics of Calls				
Calls during office hours	169 (35.6)	610 (78.3)	779 (100)	<0.001
Calls during after hours - weekday	164 (32.5)	340 (67.5)	504 (100)	<0.001
Calls during after hours - weekend	141 (33.1)	285 (66.9)	426 (100)	<0.001
Response Time (minutes)				
Overall	11.4 (20.7)	21.8 (38.4)	18.9 (34.6)	<0.001
Calls during office hours	12.7 (23.0)	29.9 (46.5)	26.0 (42.9)	<0.001
Calls during after hours - weekday	11.3 (16.5)	16.7 (30.0)	15.0 (26.6)	0.036
Calls during after hours - weekend	9.9 (22.1)	11.8 min (23.0)	11.2 (22.7)	0.425
Time to clear call (hours)				
Overall	0.9 (1.6)	0.8 (1.0)	0.9 (1.2)	0.169
Calls during office hours	0.8 (1.2)	1.0 (1.0)	0.9 (1.1)	0.103
Calls during after hours - weekday	1.1 (2.1)	0.8 (1.1)	0.9 (1.5)	0.025
Calls during after hours - weekend	0.9 (1.2)	0.6 (0.9)	0.7 (1.0)	0.023
Distance of caller to University of Alberta Hospital (kms)				
0-50 Km	166 (35.0)	730 (59.1)	896 (52.4)	<0.001
51-100	68 (14.4)	98 (7.9)	166 (9.7)	0.180
101-150	64 (13.5)	118 (9.6)	182 (10.7)	0.422
151-200	42 (8.9)	68 (5.5)	110 (6.4)	0.491
201-250	66 (14.0)	86 (7.0)	152 (8.9)	0.155
251-300	39 (8.2)	52 (4.2)	91 (5.3)	0.423
>300	29 (6.1)	83 (6.7)	112 (6.6)	0.911

*for comparison of T1 to T2

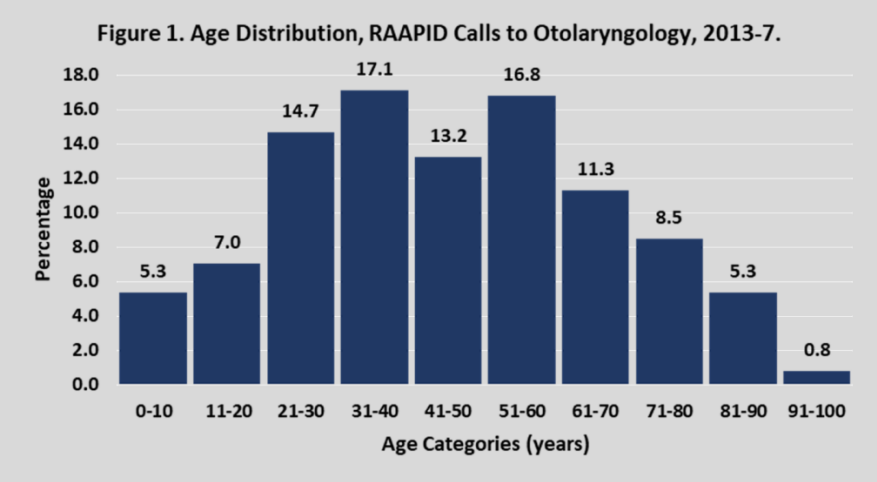

Figure 2. Age Distribution, RAAPID Calls to Otolaryngology – Head and Neck Surgery, 2013-7.

With respect to the primary endpoint, 62.3% (1064/1709) of RAAPID calls resulted in the reduction of ED visits. Of these calls, 83% (n=884) of calls resulted in advice being provided to the calling physician, allowing for care delivery in the community while 17% (n=180) of calls resulted in a referral to a specialists clinic, allowing for outpatient consultations. Of the remaining calls, 37.7% (n=645) of calls resulted in a recommendation of an ED visit or direct admission to hospital. A slightly higher reduction in ED visits was noted during normal office hours (n=557, 71.5%) compared to after office hours calls (n=507, 54.5%) ($p<0.001$).

Comparing T1 and T2, more calls in T2 resulted in a reduction of ED visits (68.6%) than in T1 (45.8%): adjusted odds ratio (OR) 2.48 (95% CI: 1.99 to3.08). This trend was consistently observed in both calls during office hours and after-hours calls during the weekday or weekend. Moreover, more calls completed during office hours resulted in a reduction of ED visits than during after-hours irrespective of time period evaluated. (Table 2; Figure 3)

Table 2: Dispositions of calls by time frame.

	T1	T2	Overall
Overall	**474 (100%)**	**1235 (100%)**	**1709 (100%)**
1. Reducing ED Visits – Overall	**217 (45.8%)**	**847 (68.6%)**	**1064 (62.3%)**
a. Advice Provided	188 (86.6%)	696 (82.2%)	884 (83.1%)
b. Referral to Clinic	29 (13.4%)	151 (17.8%)	180 (16.9%)
2. ED Visit/Direct Admission Recommended	**257(54.2%)**	**388 (31.4%)**	**645 (37.7%)**
Crude OR (95% CI) – T2 compared to T1; Adjusted OR (95% CI)**	2.58 (95% CI: 2.08 to 3.21) 2.48 (95% CI: 1.99.0 to 3.08)		-
Calls Office Hours (n=779)	**169 (35.7%)**	**610 (49.4%)**	**779 (45.6%)**
1. Reducing ED Visits	**92 (54.4%)**	**465 (76.2%)**	**557 (71.5%)**
a. Advice Provided	80 (87.0%)	385 (79.4%)	465 (83.5%)
b. Referral to Clinic	12 (13.0%)	80 (16.5%)	92 (16.5%)
2. ED Visit/Direct Admission Recommended	**77 (45.6%)**	**145 (23.8%)**	**222 (28.5%)**
Crude OR – T2/T1; Adjusted OR (95% CI)**	2.68 (95% CI: 1.88 to 3.83) 2.54 (95% CI: 1.77 to 3.64)		-
Calls- After-Office Hours(n=930)	**305 (64.3%)**	**625 (50.6%)**	**930 (54.4%)**
1. Reducing ED Visits	**125 (41.0 %)**	**382 (61.1%)**	**507 (54.5%)**
a. Advice Provided	108 (86.4%)	311 (81.4%)	419 (82.6%)
b. Referral to Clinic	17 (13.6%)	71 (18.6%)	88 (17.4%)
2. ED Visit/Direct Admission Recommended	**180 (59.0 %)**	**243 (38.9%)**	**423 (45.5%)**
Crude OR – T2/T1; Adjusted OR (95% CI)**	2.26 (95% CI: 1.71 to 2.99) 2.19 (95% CI: 1.66 to 2.91)		-

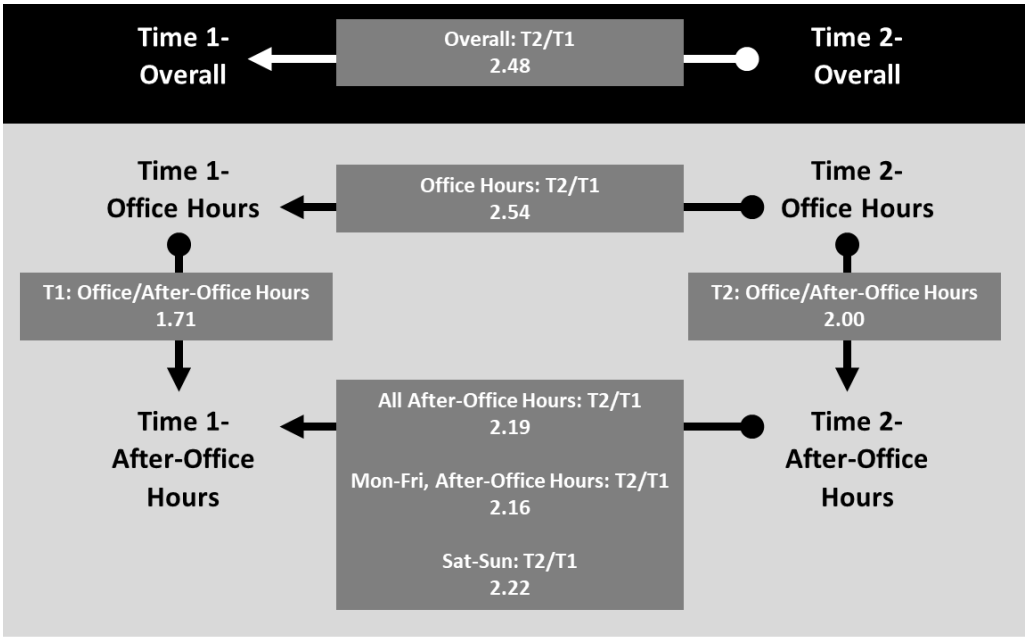

Figure 3. Adjusted Odds Ratios of Calls Reducing ED Visits Across Time Frames and Office Hours.

With respect to cost avoidance, in total, the cost avoided from the telephone consultations was estimated to be $156,618.08, with more cost avoided in T2 ($114,393.86) than T1 ($42,224.22) which is a reflection of both the increased number of calls and higher percentage of calls with reducing ED visits. In T1, more cost was avoided during after-office hours ($24,299.34) than during office hours ($17,924.88). In T2, the cost avoided during after-office hours ($72,749.61) was also more than during office hours ($41,644.25). See Table 3. Overall, the average cost avoided per consultation was $91.64, with T2 ($92.63) slightly higher than T1 ($89.08).

Table 3. Cost avoided.

	Cost Avoided (Mean Cost Avoided per Call)	Cost Avoided excluding the call claims ($77.74) by consultants (Mean Cost Avoided per Call)
Time 1: Office Hours (n=169)	$17,924.88 ($106.06)	$17,924.88 ($106.06)
Office hours: advice (n=80)	16,413.60	16,413.60
Office hours: referral to clinic (n=12)	1,511.28	1,511.28
Office hours: ED (n=77)	0.00	0.00
Time 1: After-Office Hours (n=305)	24,299.34 (79.67)	24,299.34 (79.67)
After-Office hours: advice (n=108)	22,158.36	22,158.36
After-Office hours: referral to clinic (n=17)	2,140.98	2,140.98
After-Office hours: ED (n=180)	0.00	0.00
All calls in T1 (n=474)	42,224.22 (89.08)	42,224.22 (89.08)
Time 2: Office Hours (n=610)	41,644.25 (68.27)	89,065.65 (146.01)
Office hours: Advice Given (n=385)	49,060.55	78,990.45
Office hours: Referral to clinic (n=80)	3,856.00	10,075.20
Office hours: ED referral (n=145)	-11,272.30	0.00
Time 2: After-Office Hours (n=625)	72,749.61 (116.40)	72,749.61 (116.40)
After-Office hours: advice (n=311)	63,807.87	63,807.87
After-Office hours: referral to clinic (n=71)	8,941.74	8,941.74
After-Office hours: ED (n=243)	0.00	0.00
All calls in T2 (n=1235)	114,393.86 (92.63)	161,815.26 (131.02)
All calls in T1 and T2 (n=1709)	$156,618.08 ($91.64)	$204,039.48 ($119.39)

3.5. INTERPRETATION

Our study showed that telephone consultations to OHNS reduced ED visits in Alberta. Indeed, over 60% of all calls reduced ED visits. Importantly, the majority of these telephone consultations allowed patients to be cared for by their family physicians with <20% requiring additional outpatient consultation with a specialist consults. Moreover, the cost avoidance to the system study was substantial despite the procedural changes which relied more on specialists than residents.

Our results are in line with similar studies conducted nationally and internationally. Wilson et al. (2016)[1] found British Columbia's telephone consultation program (Rapid Access to Consultative Expertise) resulted in a 60% prevention in a face-to-face specialist consultation and 32% prevention of ED visits. British Columbia's pilot project offering only access to cardiologists for family physicians reported that 80% of calls addressed issues adequately through telephone and 20% resulted in further consultation.[5] Wegner et al (2008)[6] in the United States reported that among 306 consults between primary care physicians and pediatric subspecialist, 32% avoided pediatric subspecialist visits, 11% avoided hospital transfers, 5% avoided hospital admissions, and 5% avoided ED visits. In a study in France, Salles et al. (2014)[7] reported that 38.3% of 714 calls to geriatricians resulted in advice only and only 4.3% resulted in direct admission to ED, 9.2% in day hospital visit, and 5.3% geriatric consultation. However, Salles reported that 42.9% resulted to planned hospitalization to a geriatrics ward. With respect to costs, British Columbia's program reported a cost avoidance of up to $200/call, with an estimated savings of $9005 for 148 calls reviewed.[1] Wegner et al. (2008)[6] reported an estimated savings of $477,274 within the pediatric population. This value represented all associated costs of ED visits and associated costs of hospitalizations, in contrast to our study which only considered physician's consultation fees and average ED costs.

Despite our findings, our study is not without limitations. This study only evaluated the dispositions at the end of telephone consultations. The events after the call were not followed through and may not reflect the true disposition. Call resulting in advice (reducing ED visits), for example, may or may not have resulted in ED visits. Physicians may not comply with all recommendations; however other studies have shown a high rate of compliance (>90%).[8] Second, the differences noted between T1 and T2 could be driven by other factors which we were not able to discern. For example, the disproportionately large volume of calls in T2 could represent an increased willingness to use the service in cases which were not as severe compared to when the service initially was launched. Moreover, RAAPID policy routed all non-

urgent calls received from 2200-0900H to 0900H. As familiarity with the calls increased by the RAAPID center a disproportionately greater number of calls may have been routed to office hours over time.

3.6. CONCLUSION

Telephone consultations to OHNS reduced ED visits and specialty consultations in northern Alberta. More reduction in ED visits and cost avoided occurred in T2 than T1.

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Appendix 1 . Cost Avoidance Estimates Per RAAPID Call to Otolaryngology – Head and Neck Surgery (OHNS)

	(a) Claim by Referring MD for the call* (CAD)	(b) Claim by OHNS for the call** (CAD)	(c) Claim by OHNS for elective specialty clinic*** (CAD)	(d) Average Cost of ED Visit for Diseases of the Ear-Nose-Throat**** (CAD)	(e) =a+b+c+d Total Claims plus ED cost per patient (CAD)	(f) =205.17-e Cost Avoided per Call (CAD)
Time 2: Office Hours (calls taken by OHNS Consultants						
Office hours: Advice Given	0	$ 77.74	$ 0	$ 0	$ 77.74	$ 127.43
Office hours: Referral to clinic	0	77.74	79.23	0	156.97	48.2
Office hours: ED referral	0	77.74	0	205.17	282.91	-77.74
Time 2: After-Office Hours (calls taken by OHNS residents)						
After-Office hours: advice	0	0	0	0	0	205.17
After-Office hours: referral to clinic	0	0	79.23	0	79.23	125.94
After-Office hours: ED	0	0	0	205.17	205.17	0
Time 1: Office Hours (calls taken by OHNS residents)						
Office hours: advice	0	0	0	0	0	205.17
Office hours: referral to clinic	0	0	79.23	0	79.23	125.94
Office hours: ED	0	0	0	205.17	205.17	0
Time 1: After-Office Hours (calls taken by OHNS residents)						
After-Office hours: advice	0	0	0	0	0	205.17
After-Office hours: referral to clinic	0	0	79.23	0	79.23	125.94
After-Office hours: ED	0	0	0	205.17	205.17	0

*Referring MD would not bill for the call to the OHNS but for the patient's consultation.
**Alberta Medical Association Fee Navigator. Health Service Code 03.01LJ (Physician to physician telephone consultations): $ 77.74
***Alberta Medical Association Fee Navigator. Health Service Code 03.08A (Comprehensive consultation): $79.23
****Government of Alberta. Hospital Ambulatory Care Case Costs - 2017 version

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CHAPTER 4. SUMMARY

4.1 SUMMARY OF RESEARCH

This thesis aimed to evaluate the use of telephone consultations between healthcare providers and specifically the potential impact of telephone consultations in Alberta. As noted in Chapter 2 (environmental scan), the range of processes is very diverse, not only in the specialty areas served, but also in program characteristics and availability. Indeed, although Canada has largely focused on services between physicians, many programs globally provide a wider approach allowing consultations from other allied health professionals. Moreover, unlike many programs in Canada, and within RAPIDs program in Alberta, most programs are operated as a direct call service to the specialists (i.e., do not use a third party intermediator or paging system). Although few formal evaluations of the programs have been completed to date, in all instances where completed, the consultation programs have shown improvements in either patient care and/or use of health services, particularly a reduction in ED visits.

In Alberta, telephone consultations have provided improved access to specialists. The quality assurance study (Chapter 3) on RAAPID-North's consultations to OHNS showed that overall, 62% of telephone consultations reduced emergency ED visits, with more reduction of visits in T2. This finding is interesting as in T1 the majority of care was provided by residents, whereas in T2 the majority of care was provided directly by the specialists in most instances. Although there is an additional cost to care for more specialists in T2 (as opposed to residents in T1), the better outcomes in terms of ED visits avoided would be expected to be an important outcome for patients. Overall, the estimated total cost avoided was $156,618.08. These results in terms of reducing ED visits are similar or better than other studies found in literature. Interesting, the use of a triage system in Alberta's RAAPID program appears to be similar or better with respect to important outcomes as those programs globally that have used direct physician to physician processes.

4.2. IMPLICATIONS FOR FUTURE RESEARCH

RAAPID-North's telephone consultations to OHNS are but a small subset of RAAPID's consultations. The sample is limited to consultations with OHNS and only to those consultations through RAAPID-North. In Chapter 3, we analyzed 1709 consultations over 4 years, i.e., roughly 450 calls per year. However, this number pales in comparison to the annual number of RAAPID calls. In 2014-2015, for a one year period, RAAPID program had a total of 51,171 referrals.[1] Analyzing the complete data could demonstrate the

magnitude of RAAPID's impact on reducing ED visits and specialty consultations, which could be several times the numbers and ratios reported in Chapter 3.

Moreover, Chapter 3 presented the outcomes at the end of the telephone consultation. The data did not include the status of the patients after the telephone consultation. We do not know the actual status of the patients after the consultation, e.g., whether the patients remained in the community or visited the ED or specialists. A prospective quality assurance study could be designed which would be able to follow patients, measure patient characteristics and status from the time of telephone consultation and subsequent outcomes. In particular, the benefit to the patients of an immediate avoidance of an ED visit would be extremely important as the telephone consultation would be expected to reduce patient anxiety and stress, decrease time required to proceed to the ED, decrease time away from work, etc. These patient reported outcome measures were not captured in Chapter 3 but are expected to be a pivotal piece of evidence in the effectiveness of the RAAPID program which should be considered in future evaluations. Moreover, inclusion of the indirect costs to patients would facilitate a more robust cost-avoidance model which would be expected to show even more significant costs savings to not only the health system but patients.

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