Randomized controlled trial of a multisite speech pathology telepractice service providing swallowing and communication intervention to patients with head and neck cancer: Evaluation of service outcomes

Clare L. Burns, BSpPath, PhD,1,2,3* Elizabeth C. Ward, BSpThy, Grad Cert, PhD,2,3,4 Anne J. Hill, BSpPath, PhD,2,3 Sanjeeva Kularatna, PhD,5 Joshua Byrnes, PhD,1 Lizbeth M. Kenny, MBBS, FRANZC1,6

1Speech Pathology and Audiology Department, Royal Brisbane and Women’s Hospital, Brisbane, Queensland, Australia, 2The University of Queensland, School of Health and Rehabilitation Sciences, Brisbane, Queensland, Australia, 3Centre for Research Excellence in Telehealth, The University of Queensland, Brisbane, Queensland, Australia, 4Centre for Functioning and Health Research, Metro South, Brisbane, Queensland, Australia, 5Centre for Applied Health Economics, Menzies Health Institute Queensland, Griffith University, Brisbane, Australia, 6Central Integrated Regional Cancer Services, Brisbane, Queensland, Australia, 7School of Medicine, The University of Queensland, Brisbane, Queensland, Australia, 8Cancer Care Services, Royal Brisbane and Women’s Hospital, Brisbane, Queensland, Australia.

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ABSTRACT: Background. The purpose of this study was to present our evaluation of a new speech pathology telepractice service supporting the swallowing and communication management of patients with head and neck cancer.

Methods. A multicenter randomized controlled trial was conducted within a large public cancer service. Referrals from speech pathologists at 3 regional sites (spoke sites) were managed by a specialist clinician from a cancer center (hub site) either via standard care (phone/email support/appointments at the hub site) or a newly established telepractice service (online consultation between the hub site and spoke site).

Results. Eighty-two referrals (39 for standard care and 43 for telepractice care) were managed. Service efficiency favoring the telepractice model was reported with a significant reduction in the number (p = .004) and duration (p = .024) of contact events required to manage the referrals. Higher consumer and clinician satisfaction was also reported for the telepractice service.

Conclusion. A speech pathology telepractice service benefits both the patient and health provider through higher service efficiency and treatment satisfaction. ©2017 Wiley Periodicals, Inc. Head Neck 39: 932–939, 2017

KEY WORDS: speech pathology, telepractice, head and neck cancer

INTRODUCTION

It is widely considered best practice for patients with head and neck cancer to be treated at high-volume specialist cancer centers supported by an expert multidisciplinary team.1–3 Speech pathologists are integral members of the head and neck cancer team and specialize in the assessment, management, and rehabilitation of swallowing and communication disorders. Because of the complex nature of these deficits, expertise in a wide range of specialist clinical tasks is required4–15 to provide prompt and accurate intervention that minimizes medical complications and optimizes functional outcomes.5,7–9,12,16–18

After cancer treatment, there is an expectation that nonmetropolitan patients will be able to receive rehabilitation at their local health facility. However, not all speech pathologists have the knowledge and skills required to manage this population independently. Hence, ongoing clinical support is generally provided to the local speech pathologist by the specialist clinician from the cancer center and/or the patient travels back to the specialist service for direct intervention.16–19 Issues with this current model are that telephone and email contact relies solely on verbal/written reports, which are difficult to validate and risk omissions or the misinterpretation of clinical information. Furthermore, repeated consultations between the regional and specialist clinician lead to multiple appointments at the local facility and/or cancer center resulting in increased costs for the health service and additional financial and emotional pressure for the patient and their family.20–23,25 New healthcare models that address the inequity of access to head and neck cancer specialist services, particularly for patients living in regional and remote areas, are necessary to optimize health/functional outcomes and better direct the effective and efficient use of scarce health service resources.

Telepractice offers a potential solution to this issue by utilizing videoconferencing to provide real-time clinical consultation between the patient and local clinician at the regional facility and the specialist clinician at the cancer
center. 22,24,26–33 To date, studies exploring the use of telepractice to support the delivery of speech pathology intervention to patients with head and neck cancer have been limited to validation or small-scale feasibility trials. An initial case series described the use of telepractice to support swallowing and communication management directed by a remote specialist clinician to patients with head and neck cancer supported by their local speech pathologist, nurse, and/or carer. 31 After this work, a series of 3 studies evaluated the use of a personal computer-based videoconferencing system to deliver speech pathologist intervention to patients with head and neck cancer. The first 2 studies 32,33 investigated the feasibility and reliability of delivering swallowing and communication intervention via telepractice after laryngectomy surgery, including surgical voice restoration. The initial study 32 confirmed the technical specifications and clinical process required to deliver care that was comparable to face-to-face intervention. A second study 33 tested this procedure using a simulated clinical telepractice service over a 1700-km distance and reported high agreement and satisfaction from both clinicians and patients. A third study,34 investigating the validity and reliability of conducting clinical swallowing assessments via telepractice, assessed 100 patients with varying dysphagia severity, with 25% of the cohort having head and neck cancer. Using simultaneous online and face-to-face ratings, high levels of agreement were achieved between the 2 conditions across all components of the clinical swallowing assessment, confirming that the telepractice model was both safe and valid.

Subsequent translation of these research findings into clinical practice were reported in a pilot study 22 conducted between a specialist cancer center (Royal Brisbane and Women’s Hospital) and a regional cancer facility (Nambour Hospital) located 100 km apart within Queensland, Australia. In a 5-month period, 18 different patients received swallowing, communication, and laryngectomy assessment and rehabilitation over 50 telepractice appointments. The telepractice service treated all patients successfully while achieving preliminary patient cost savings and high consumer and clinician satisfaction. These positive findings supported the expansion of the telepractice service to 2 additional sites within the cancer service.

To date, there are no published studies reporting on the formal integration or evaluation of large-scale speech pathology telepractice services for head and neck cancer intervention. Hence, the objectives of this study were to (1) establish the abovementioned expanded multisite hub and spoke telepractice service, and (2) conduct a health service evaluation comparing the service outcomes of the new telepractice model of care (TMOC) with the existing support of the standard model of care (SMOC). The aim of this study was to examine service efficiency and participant satisfaction of the new telepractice service model, and it was hypothesized that the TMOC would provide greater service efficiency and higher consumer and clinician satisfaction than the existing SMOC.

MATERIALS AND METHODS

This was a randomized controlled trial using multicenter parallel groups with balanced randomization (1:1) conducted in the Central Integrated Regional Cancer Services (CIRCS), Queensland, Australia.

Health service

CIRCS is the largest public cancer service in Queensland, Australia. The service supports 1.6 million people over an area of 561,824 km², in which 52% of the population lives outside the metropolitan city of Brisbane (Royal Brisbane and Women’s Hospital, 2012). Within CIRCS, head and neck cancer treatment is predominantly provided at the Royal Brisbane and Women’s Hospital and supported by 6 regional cancer facilities. Three of these facilities, Nambour General Hospital, Hervey Bay Hospital, and Rockhampton Hospital, participated in this study located approximately 102 km, 285 km, and 630 km, respectively, north of Brisbane. After completion of treatment at Royal Brisbane and Women’s Hospital, patients returned home and accessed allied health and nursing intervention within their residential health service district, only returning to Royal Brisbane and Women’s Hospital for specialist medical reviews and medical imaging procedures.

This project was granted ethical approval from the Human Research Ethics Committee of the Royal Brisbane and Women’s Hospital, Queensland Health and the Medical Research Ethics Committee of The University of Queensland (HREC/12/QRBW/370). It was conducted according to the Consolidated Standard of Reporting Trials 35 and all participants provided written consent for their involvement in the study.

Participants

All participants were consecutively recruited from within CIRCS. For inclusion, patients had to be: (1) adults (>18 years) who had undergone treatment for head and neck cancer at Royal Brisbane and Women’s Hospital; (2) residing in the health service district of the 3 participating regional cancer sites; and (3) referred to Royal Brisbane and Women’s Hospital by their local speech pathologist who was requesting support to manage a clinical problem associated with their head and neck cancer treatment. Exclusion criteria included patients who had received treatment for their head and neck cancer at another healthcare facility, or individuals unable to provide independent informed consent. Patients with auditory or visual difficulties were not excluded from the study, as their local speech pathologist was able to assist them to complete the tasks required during the telepractice session. Equally, the attending speech pathologist controlled the telepractice system and, therefore, the patient was not required to have prior experience using this technology.

Sample size

Because cost was the primary outcome for the overall health service evaluation (of which this analysis is a component), the target sample size for the study was based on the smallest expected difference in travel cost between the 2 service delivery models ($129 at the Nambour site; informed from a pilot study 22). This analysis assumed equal distribution of enrolment from each of the 3 regional spoke sites and an expected SD between sites of $209.
With 80% power to detect statistically significant difference at a 95% confidence level, an overall sample size of 80 was estimated, with the target of 40 referrals per service delivery model.

Referrals and randomization

All eligible patients were randomized into either the SMOC or the TMOC at the time the regional speech pathologist requested specialist support from the metropolitan Royal Brisbane and Women’s Hospital speech pathologist. A block randomization sequence for each spoke site was generated at the start of the study by an independent researcher at another institution using a random number generator (www.researchrandomizer.org). Each allocation was kept in a sealed envelope until the referral was initiated and confirmed (via patient consent) by the referring regional clinician to the Royal Brisbane and Women’s Hospital speech pathologist. Referrals from each regional site were then allocated to management via either the SMOC or TMOC (see Figure 1). Because this study provided direct intervention, the researchers, patients, and participating speech pathologists were unable to be blinded to the allocated model of care.

Discharge from either model of care occurred when the clinical problem was resolved and/or if both clinicians agreed that ongoing support from the Royal Brisbane and Women’s Hospital speech pathologist was not required to manage the clinical issue. Eligible patients who had been managed and discharged from the service could be referred again into the study at a later time for management of a new issue, if required. On referral of a new issue, these patients underwent randomization as per their initial referral. For both models of care, if the clinical problem could not be managed adequately in the allocated manner at the regional site, the patient traveled to the Royal Brisbane and Women’s Hospital to attend a face-to-face appointment with the Royal Brisbane and Women’s Hospital speech pathologist.

Interventions

The same clinicians were involved in both the SMOC and TMOC and included: (1) a single speech pathologist with over 15 years of experience in head and neck cancer management who provided the intervention from the metropolitan Royal Brisbane and Women’s Hospital site; and (2) 9 speech pathologists working in the head and neck cancer caseload within the Speech Pathology Departments at the 3 participating regional cancer facilities. The number of staff participating at the regional sites was influenced by staff attrition (3 clinicians at 2 of the regional sites) and the rotation of novice clinicians through the service every 8 to 12 months to support workforce training at the other spoke site. The regional speech pathologists had a range of experience in head and neck cancer management (range, 0–5 years) with the majority (63%) having less than 2 years of clinical experience. All staff completed practical telepractice procedure and equipment training (approximately 2 hours’ duration) via videoconferencing with the Royal Brisbane and Women’s Hospital speech pathologist before commencing the service.

Standard model of care

Referrals randomized to the SMOC were managed as per the historical speech pathology support model of care within CIRCS. This involved the Royal Brisbane and Women’s Hospital speech pathologist providing support
to patients at their regional cancer site (ie, patients’ local service) via email/telephone contact with their regional clinician as required. The duration and frequency of contact was determined on a case-by-case basis by both the Royal Brisbane and Women’s Hospital and regional speech pathologists, depending on the nature and complexity of the patients’ clinical needs, and continued until discharge occurred. Referral information for the SMOC was communicated to the Royal Brisbane and Women’s Hospital speech pathologist via telephone or email, and the outcome of clinical events were documented in the medical records, as per standard practice.

**Telepractice model of care**

Referrals randomized to the TMOC were managed in telepractice sessions between the Royal Brisbane and Women’s Hospital speech pathologist (hub site), and the patient with the regional speech pathologist at their local health facility (spoke site). Administrative, clinical, and technical procedures for the clinic were established based on published guidelines and local health service requirements. Referral information was communicated using a referral form, which reported the patient’s current status, the reason for the referral, and medical history. Telepractice sessions were conducted within scheduled 1-hour appointments during designated weekly clinics and ad hoc appointments were offered when required. Repeat telepractice appointments were offered until discharge occurred. A report cosigned by the attending speech pathologist was filed in the patient’s medical record at the participating sites after each telepractice session, as per health information requirements.

To deliver the TMOC, all facilities utilized identical mobile telehealth systems (see Figure 2), comprising of a videoconferencing unit (Edge 95 MXP), with Pan-Tilt-Zoom camera (Tanberg Precision HD camera), LED screen (LG Flatron M2380D-PT), and multidirectional microphone (AT871UG). A handheld medical camera system (Flexidock 200 Medical Camera System; Inline Medical and Dental, Sydney, Australia) capable of audiovisual (video and still) recordings was also utilized by the regional speech pathologist to capture and transmit close up live views of the area of clinical interest when requested by the Royal Brisbane and Women’s Hospital speech pathologist during the telepractice session. Two different imaging attachments were used: a general imaging probe for close up views of the oral cavity or tracheostoma and an intraoral probe for fine detailed images of the oral mucosa or dental area. Telehealth calls were made between the Royal Brisbane and Women’s Hospital and the regional sites via the Queensland Health’s telehealth system, a virtual private network, using an internet protocol at bandwidth of at least 1 Mbit/s.

**Outcome measures**

For the service evaluation, the primary outcome measure was the efficiency of the TMOC compared to the SMOC. The secondary outcome measures were consumer and clinician satisfaction for the 2 different service delivery models.

**Service statistics**

Prospective service data were recorded by both the Royal Brisbane and Women’s Hospital and regional speech pathologists for each referral managed including: the number of referrals initiated; the time from referral to response by the Royal Brisbane and Women’s Hospital speech pathologist; the time from the initial response by the Royal Brisbane and Women’s Hospital speech pathologist to the initial clinical management session; the number of contact events per referral (ie, email, telephone calls, face-to-face/telepractice appointments); and time spent per contact event per referral. Any referrals initiated to other professionals (external to speech pathologist) were noted, including if the patient was required to travel to the Royal Brisbane and Women’s Hospital for referral management, and, finally, any technical difficulties were recorded.

**Patient information**

Patient outcomes documented included: (1) demographic information; (2) medical treatment provided (ie, surgery +/- chemoradiotherapy [CRT], or radiotherapy +/- chemotherapy); (3) the clinical group treated (laryngectomy, swallow, other); and (4) phase of care (pretreatment, acute posttreatment phase [medical treatment completed <6 months], postacute posttreatment phase [medical treatment completed >6 months]).

**Consumer satisfaction**

Patient satisfaction was evaluated on discharge from each model of care. The Functional Assessment of Chronic Illness Therapy Treatment Satisfaction questionnaire (FACIT-TS, version 1.0) was completed to seek patient satisfaction with the speech pathology treatment provided relative to (1) effectiveness of treatment (TS1), (2) whether the treatment was right for the patient (TS4), treatment
satisfaction (TS5), (3) treatment recommendation (TS7), and (4) overall treatment rating (TS8). An additional survey was completed comprising of 5 questions relating to the patients’ satisfaction with the speech pathology model of care they attended. These questions were rated on a 5-point Likert type scale with: 1 = strongly disagree; 2 = disagree; 3 = unsure; 4 = agree; and 5 = strongly agree.

Clinician satisfaction

Clinician satisfaction was also reported on discharge using a 6-item questionnaire relating to speech pathologist satisfaction with the model of care provided, and their perceptions of the efficiency and effectiveness of the service. These questions were also rated using the 5-point Likert type scale: 1 = strongly disagree; 2 = disagree; 3 = unsure; 4 = agree; and 5 = strongly agree.

Statistical analysis

Continuous data were reported as mean ± SD, and categorical data, as numbers and percentages. Differences between the standard and telepractice models of care were analyzed using the Mann–Whitney U test, 1-way analysis of variance, and Pearson’s chi-square test. The p values ≤ .05 were considered significant. Contact events (eg, face-to-face or telepractice appointments) that included a medical record entry were recorded as one event, as per current activity reporting practice in the study’s health service. In addition, contact events that involved both the Royal Brisbane and Women’s Hospital and the regional clinician (eg, telephone call, telepractice appointment) were recorded once to reflect the activity/time per referral, as opposed to activity/time per site. All data were analyzed using the SPSS software package, version 22 (IBM SPSS, Chicago, IL). The FACIT-TS-G and satisfaction questionnaires are composed of single and multi-item scales answered on a Likert scale (0–2, 0–4, or 0–5). The FACIT-TS-G questionnaire was completed in accordance with the published scoring and interpretation guidelines, in which all items are evaluated individually and compared between the SMOC and TMOC groups.

RESULTS

Demographic results

The study was conducted between July 2013 and October 2015. Over the 27-month service period, 91 referrals from the 3 regional sites were received by the Royal Brisbane and Women’s Hospital speech pathology service. Of these, 9 referrals were discontinued within the study because of: withdrawal of consent (n = 3); incomplete management due to failure to attend appointments (n = 4); or the patient died during management (n = 2) resulting in 82 referrals receiving complete management (see Figure 1). In total, 43 referrals were managed by the TMOC and 39 were managed by the SMOC.

Patient demographics and clinical characteristics are summarized in Table 1. The 82 referrals related to issues arising from 47 different patients (29 patients had a single referral, 6 had 2 referrals, 7 had 3 referrals, and 4 had 4–6 referrals). The mean age of patients was 65 years (SD, 7.45; range, 62–67 years) and 64 years (SD, 7.58; range, 61–66 years) for the SMOC and TMOC groups, respectively, and this difference was not statistically significant (p = .525). The remaining demographics of the participants in both groups were comparable except for treatment modality with more patients having received combined treatment (surgery ± CRT; p = .018) in the TMOC group. Similar referral numbers were initiated at the acute posttreatment and postacute posttreatment phases of care and most referrals were for intervention for patients who had undergone laryngectomy surgery with surgical voice restoration (Table 1).

Primary outcome

Service efficiency. Service outcomes for the TMOC and SMOC groups are described in Table 2. There were no significant differences between the models of care regarding the duration of time from referral to response or initial response to first management session. Regarding the number and duration of contact events required to manage the referred clinical problems, significantly less number of contact events and time was required to manage each referral within the TMOC group.

Six face-to-face speech pathology sessions at the Royal Brisbane and Women’s Hospital were required for 5 patient referrals in the SMOC group (4 referrals required 1 face-to-face appointment, and 1 required 2 face-to-face appointments at the Royal Brisbane and Women’s Hospital). The clinical issues requiring additional support included training in the use of a Therabite for trismus management and videofluoroscopy swallow studies to evaluate tracheoesophageal speech and swallowing function. Patient attendance rates for both telepractice sessions and SMOC appointments at the Royal Brisbane and Women’s Hospital were high, and no referrals in the TMOC group required travel to the Royal Brisbane and Women’s Hospital for speech pathology management.

Associated issues requiring referrals to other members of the multidisciplinary team (external to speech pathology) were required for 33 referrals. These included referrals to medical specialists, the general medical
practitioner, other allied health professionals (dietetics, physiotherapy, and psychology), and specialist nurses. Statistical analysis of the proportion of patients who required additional multidisciplinary team management was significantly higher (chi-square $= 11.4; p < .001$) in the TMOC group (51%) as compared to the SMOC group (28%). Of these multidisciplinary team referrals, in the SMOC group, 36% (4/11) were required to travel to the Royal Brisbane and Women’s Hospital for management, which was significantly higher (chi-square $= 4.8; p < .029$) than for the TMOC group (only 13%; 3/22, required travel to the Royal Brisbane and Women’s Hospital for management).

**Telehealth service sessions.** Results of the telepractice service sessions are also summarized in Table 2. The average duration of a telehealth session (ie, duration of online connection only) was 47 minutes, whereas the average duration of a telepractice appointment (ie, time of online connection plus administration/report time) was 58 minutes. An average of 3 telehealth sessions (range, 1–7 sessions) were required to manage each referral with 4 additional contact events (eg, telephone call and email) required between the treating clinicians to support cohesive case management. Minimal technical difficulties were recorded, occurring in 3% of all telepractice sessions. These issues included a nonfunctioning Pan-Tilt-Zoom camera, the inability to display images from the peripheral devices (medical camera system or computer laptop), and disconnection of a network port. Of these, only 4 resulted in cancellation of the session (equivalent to 1.2% of all delivered sessions).

**TABLE 2. Summary of service outcomes.**

| Variables                                               | SMOC Mean (SD) | Range | TMOC Mean (SD) | Range | $p$ value |
|---------------------------------------------------------|----------------|-------|----------------|-------|-----------|
| Referral and response times                             |                |       |                |       |           |
| Days from referral to response by the Royal Brisbane    | 0.2 (0.71)     | 0–4   | 0.41 (1.11)    | 0–6   | .320      |
| and Women’s Hospital speech pathologist                |                |       |                |       |           |
| Days from response to management with the Royal         | 3.20 (3.74)    | 0–11  | 3.12 (3.44)    | 0–14  | .928      |
| Brisbane and Women’s Hospital speech pathologist       |                |       |                |       |           |
| All contact events                                      |                |       |                |       |           |
| No. of contact events per referral                      | 12.3 (9.69)    | 3–41  | 7.44 (4.58)    | 2–24  | .004      |
| Duration of contact events per referral, min           | 384.20 (352.59)| 60–1915| 248.25 (151.75)| 45–705| .024      |
| Telepractice events only                               |                |       |                |       |           |
| No. of telepractice contact events per referral         | N/A            | N/A   | 3.11 (1.90)    | 1–8   | N/A       |
| No. of non-telepractice contact events per referral (eg, email) | N/A            | N/A   | 4.25 (3.48)    | 1–16  | N/A       |
| Duration of telepractice appointments, min, online + administration time | N/A            | N/A   | 58.17 (14.91)  | 18.75–80 | N/A      |
| Duration telepractice appointments, mins, online time only | N/A            | N/A   | 47.69 (14.12)  | 17.50–70 | N/A      |

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**TABLE 3. Patient and clinician satisfaction.**

| Parameter                                                   | SMOC Mean (SD) | Range | TMOC Mean (SD) | Range | $Z$    | $p$ value |
|-------------------------------------------------------------|----------------|-------|----------------|-------|--------|-----------|
| Patients satisfaction                                       |                |       |                |       |        |           |
| FACIT-TS-G, question 1                                      | 3.17           | 3.41  | 1.604          | .109  |        |           |
| Compared to what you expected, how do you rate the effectiveness of treatment so far? |                |       |                |       |        |           |
| FACIT-TS-G, question 4                                      | 2.43           | 2.83  | 2.812          | .005  |        |           |
| Do you feel you received the treatment that was right for you? |                |       |                |       |        |           |
| FACIT-TS-G, question 5                                      | 2.41           | 2.67  | 2.008          | .045  |        |           |
| Are you satisfied with the effects of this treatment so far? |                |       |                |       |        |           |
| FACIT-TS-G, question 7                                      | 1.87           | 1.95  | 1.093          | .274  |        |           |
| Would you recommend this treatment to others with your illness? | 2.89           | 3.39  | 2.502          | .012  |        |           |
| FACIT-TS-G, question 8                                      |                |       |                |       |        |           |
| How do you rate this treatment overall?                    | 4.05           | 4.41  | 2.028          | .043  |        |           |
| I felt the problem I experienced was efficiently resolved. (range 0–5) | 4.36           | 4.48  | 4.442          | <.001 |        |           |
| Clinician satisfaction                                     |                |       |                |       |        |           |
| I was satisfied with level of support the model of care provided to my patient. (range 0–5) | 4.43           | 4.90  | 4.550          | <.001 |        |           |
| The model of care was efficient in meeting the needs to resolve the clinical issue for my patient. (range 0–5) | 4.31           | 4.81  | 3.539          | <.001 |        |           |
| The model of care was effective in meeting the needs to resolve the clinical issue for my patient. (range 0–5) | 4.36           | 4.88  | 4.442          | <.001 |        |           |

**Abbreviations:** SMOC, standard model of care; TMOC, telepractice model of care; FACIT-TS-G, Functional Assessment of Chronic Illness Therapy Treatment Satisfaction questionnaire. Scales for FACIT-TS-G, version 1: TS1 $= 1$ (a lot worse) to 4 (a lot better); TS4 and TS5 $= 0$ (not at all) to 3 (yes, completely); TS7 $= 0$ (no), 1 (maybe), 2 (yes completely); and TS8 $= 0$ (poor) to 4 (excellent).
Consumer and clinician satisfaction. Consumer and clinician satisfaction are summarized in Table 3. High levels of satisfaction were reported across all assessment parameters by patients in favor of the telepractice service. Although effectiveness of treatment (FACTIT question 1) and treatment recommendation (FACTIT question 7) failed to reach statistical significance, both parameters were rated higher for the TMOC group than the SMOC group. Clinician satisfaction between the 2 models of care reached statistical significance for all parameters assessed in favor of the TMOC group.

DISCUSSION

This study has described a successful multisite hub and spoke telepractice service providing remote clinical intervention to patients requiring complex laryngectomy, swallowing, and communication interventions. Evaluation of outcomes comparing this new service model with existing care has confirmed that telepractice can deliver specialist care remotely with greater service efficiency and in doing so resolve many of the reported challenges affecting access to speech pathology services for patients with head and neck cancer living in regional and rural areas.

Results support the primary study hypothesis, that the TMOC provided a speech pathology service that was more efficient than standard care. Although both services had similar referral to response times, the number and duration of contact events required to manage the referrals were significantly less in the TMOC group. Two factors influenced this. First, the clinical problem could be accurately diagnosed and managed more efficiently through real-time visualization rather than relying on the verbal descriptions of the referring clinicians. Second, the online nature of the telepractice session enabled direct and immediate interaction between the specialist clinician, the local speech pathologist, and the patient, allowing multiple clinical tasks and patient issues to be addressed effectively within the same clinical appointment. This comprehensive intervention not only directly benefited patient care, but redistribution of the time saved could be used to enhance service delivery in other clinical areas. A comprehensive economic analysis (incorporating staff and infrastructure costs) is needed to fully inform whether potential cost savings could also be realized as a result of these service efficiencies.

The audiovisual nature of the telepractice service also supported service efficiency through the identification of other clinical problems, with the online sessions resulting in twice the number of referrals to other professionals (external to speech pathologist) than in the SMOC group. In addition, by utilizing clinical images captured during the telepractice session or accessed online to triage referrals, a higher number of patients were directed to local services for management, demonstrating additional benefits in service efficiency. Although this telepractice service was initially established for speech pathology intervention, these results support the potential expansion to a multidisciplinary model to better serve the ongoing complex health needs of this patient population.

Overall, both patients and clinicians reported higher satisfaction with the TMOC, and perceived it to be more efficient than the SMOC. Access to consistent high-quality care has been identified as a priority by head and neck cancer survivors. Although patients perceived both service delivery models to be effective, the live consultative nature of the TMOC enabled them to actively participate in their healthcare management. This patient-centered approach likely led consumers to rate the treatment effects and telepractice service overall higher than standard care. Similarly, the regional speech pathologists were also more satisfied with the TMOC. Unlike the SMOC, the direct specialist review, online supervision, and immediate feedback provided in the telepractice model facilitated opportunities for improved local clinical management and professional development, resulting in perceived greater service efficiency and effectiveness.

The broad range of referrals initiated during the contact sessions (via SMOC or TMOC) reflects the diversity of specialist clinical support required to manage this complex patient group. A higher proportion of patients referred received dual modality treatment (surgery + CRT) with almost equal numbers of patients referred in the acute phase (<6 months) and postacute phase (6 months) after treatment, highlighting the need for specialized speech pathologist intervention at all phases of care. Given the complex treatment and postoperative care required, it was expected that patients postlaryngectomy were the group most often requiring specialist speech pathologist input. Clinical support for this group using the SMOC was more challenging with patients who underwent laryngectomy surgery comprising 66% of the patients required to travel to the Royal Brisbane and Women's Hospital for face-to-face speech pathologist appointments. In contrast, the online audiovisual capabilities of the telepractice system enabled the Royal Brisbane and Women's Hospital speech pathologist to accurately visualize and manage complex stoma and voice prostheses problems, which eliminated the need for the patient to travel to the cancer center to resolve these issues.

The successful expansion of the TMOC from the initial pilot study was based on a service commitment from speech pathology management at all sites and a number of key features, such as: the development of clear administration and operational procedures; establishment of formal communication and reporting processes (eg, referral and report templates); and dedicated administrative and technical support. These features enabled telepractice sessions to run smoothly with limited technical difficulties and similar duration to standard care appointments.

A few limitations are acknowledged. One specialist clinician provided support from the cancer center for the study duration. Although a variety of clinicians participated at the spoke sites, it is acknowledged that different clinical expertise/advice from the hub site may have varied service outcomes. This study was performed within 1 health service district using a dedicated telepractice network. Health services utilizing different/multiple telepractice systems and networks may need to modify their practice to accommodate for this variation and, therefore, could produce different results. This study was performed within a public health system and patient attendance and
service outcomes may vary if patients were required to pay a fee-for-service.

CONCLUSION

The findings of this study indicate that a speech pathology telepractice service providing specialist intervention to patients with head and neck cancer living in regional areas is more efficient and reports higher consumer and patient satisfaction than standard care. Additional analysis reporting on the cost-effectiveness of this service will further elucidate the potential benefits of a speech pathology telepractice service. This study supports telepractice as a viable solution for improving patient access to specialist speech pathology rehabilitation services post head and neck cancer treatment.

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REFERENCES

1. Ellis OG, David MC, Park DJ, Batstone MD. High-volume surgeons deliver sur gical margins in oral cavity cancer. J Oral Maxillofac Surg 2016:74: 1466–1472.
2. Friedland PL, Bozic B, Dewar J, Kuan R, Meyer C, Phillips M. Impact of multidisciplinary team management in head and neck cancer patients. Br J Cancer 2011;104:1246–1248.
3. Prades J, Remue E, van Hoof E, Borras JM. Is it worth reorganising cancer services on the basis of multidisciplinary teams (MDTs)? A systematic review of the objectives and organisation of MDTs and their impact on patient outcomes. Health Policy 2015;119:464–474.
4. Bressan V, Stevanin S, Bianchi M, Aleo G, Bagnasco A, Sasso L. The effects of swallowing disorders, dysgeusia, oral mucositis and kerato xemia on nutritional status, oral intake and weight loss in head and neck cancer patients: a systematic review. Cancer Treat Rev 2016;45:105–119.
5. Dwiorek RC, Kazi RA, Agrawal N, et al. Evaluation of speech outcomes following treatment of oral and oropharyngeal cancers. Cancer Treat Rev 2009;35:417–424.
6. Lann L, Samman N. Speech and swallowing following tongue cancer sur gery and free flap reconstruction – a systematic review. Oral Oncol 2013; 49:507–524.
7. van der Molen L, van Rossum MA, Burkehead LM, Smelee LE, Hilgers FJ. Functional outcomes and rehabilitation strategies in patients treated with chemoradiotherapy for advanced head and neck cancer: a systematic review. Eur Arch Otorhinolaryngol 2009:266:889–900.
8. Kreeft AM, van der Molen L, Hilgers FJ, Balm AJ. Speech and swallowing after surgical treatment advanced oral and oropharyngeal carcinoma: a system atic review of the literature. Eur Arch Otorhinolaryngol 2009:266: 1687–1698.
9. Manikantan K, Khode S, Sayed SI, et al. Dysphagia in head and neck can cer. Cancer Treat Rev 2009;35:724–732.
10. Wall LL, Ward EC, Cartmill B, Hill AJ. Physiological changes to the swal lowing mechanism following (chemo)radiotherapy for head and neck cancer: a systematic review. Dysphagia 2013;28:481–493.
11. Huteson KA, Lewin JS. Functional outcomes after chemoradiotherapy of laryngeal and pharyngeal cancers. Curr Oncol Rep 2012;14:158–165.
12. Huteson KA, Lewin JS. Functional assessment and rehabilitation: how to maximize outcomes. Otolaryngol Clin North Am 2013;46:657–670.
13. Carterill B, Cornwell P, Ward E, Davidson W, Porceddu S. Long-term functional outcomes and patient perspective following altered fractionation radiotherapy with concomitant boost for oropharyngeal cancer. Dysphagia 2012;27:481–490.
14. Maclean J, Cotton S, Perry A. Post-laryngectomy: it’s hard to swallow: an Australian study of prevalence and self-reports of swallowing function after a total laryngectomy. Dysphagia 2009;24:172–179.
15. Ward EC, Bishop Br, Frisby J, Stevens M. Swallowing outcomes following laryngectomy and pharyngolaryngectomy. Arch Otolaryngol Head Neck Surg 2002;128:181–186.
16. Wells M, Semple CJ, Lane C. A national survey of healthcare profession als’ views on models of follow-up, holistic needs assessment and survi vorship care for patients with head and neck cancer. Eur J Cancer Care (Engl) 2015;24:873–883.
17. Nund RL, Ward EC, Scarinci NA, Cartmill B, Kuipers P, Porceddu SV. Survivor’s experiences of dysphagia-related services following head and neck cancer: implications for clinical practice. Int J Lang Commun Disord 2014;49:354–363.
18. Ward EC, Hobson TK, Conroy A. Pre- and post-operative counselling and information dissemination: perceptions of patients undergoing laryngeal surgery and their spouses. Asia Pac J Speech Lang Hear 2003;8:44–68.
19. Frowen J, Cotton S, Corry J, Perry A. Impact of demographics, tumor character istics, and treatment factors on swallowing after (chemo)radiotherapy for head and neck cancer. Head Neck 2010;32:513–528.
20. Owen S, Paleri V. Laryngectomy rehabilitation in the United Kingdom. Curr Opin Otolaryngol Head Neck Surg 2013;21:45–48.
21. Roe JW, Carding PN, Rhys-Evans PH, Newbold KL, Harrington KJ, Nutting CM. Assessment and management of dysphagia in patients with head and neck cancer who receive radiotherapy in the United Kingdom – a web-based survey. Oral Oncol 2012;48:343–348.
22. Burns CL, Ward EC, Hill AJ, et al. A pilot trial of a speech pathology tele health service for head and neck cancer patients. J Telemed Telecare 2012; 18:443–446.
23. Balfie M, Butow P, O’Sullivan E, Goodberman-Hill R, Timmons A, Sharp L. The financial impact of head and neck cancer caregiving: a qualitative study. Psychooncology 2016;25:1441–1447.
24. Beswicik DM, Vashi A, Song Y, et al. Consultation via telemedicine and access to operative care for patients with head and neck cancer in a Veteran s Health Administration population. Head Neck 2016;38:925–929.
25. Rogers SN, Harvey–Woodworth CN, Hare J, Leong P, Lowe D. Patients’ perception of the financial impact of head and neck cancer and the relationship to health related quality of life. Br J Oral Maxillofac Surg 2012;50: 410–416.
26. Dorrian C, Ferguson J, Ab–See K, et al. Head and neck cancer assessment by flexible endoscopy and telemedicine. J Telemed Telecare 2009;15:118–121.
27. Stalforfs J, Edström S, Björk-Eriksson T, Mercke C, Nyman J, Westin T. Accuracy of tele-consultation compared with face-to-face consultation in head and neck cancer case conferences. J Telemed Telecare 2001;7:338– 343.
28. Savage SA, Nixon L, MacKenzie K. Teleconsultation in the management of head and neck cancer. Clin Otolaryngol 2007;32:130–132.
29. Heneghan C, Sclafani AP, Stern J, Ginsburg J. Telemedicine applications in otolaryngology. J Audiology Med 1998;18:53–62.
30. van der Pol M, McKenzie L. Costs and benefits of tele-endoscopy clinics in a remote location. J Telemed Telecare 2010;16:89–94.
31. Myers C. Telehealth applications in head and neck oncology. Int J Speech Lang Pathol Audiol (Engl) 2009;2:318–329.
32. Ward E, White J, Russell T, et al. Assessment of communication and swal lowing function post laryngectomy: a telerehabilitation trial. J Telemed Telecare 2007;3:88–91.
33. Ward E, Cumboe J, Trickey M, Hill A, Theodoros D, Russell T. Assessment of communication and swallowing post-laryngectomy: a telerehabilita tion trial. J Telemed Telecare 2009;15:232–237.
34. Ward EC, Burns CL, Theodoros DG, Russell TG. Impact of dysphagia severity on clinical decision making via telerehabilitation. Telemed J E Health 2014;20:296–303.
35. Moher D, Hopewell S, Schulz KF, et al. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised tri als. Int J Surg 2012;10:28–55.
36. Brennan DM, Tindall L, Theodoros D, et al. A blueprint for telerehabilitation guidelines. Int J Teleherbdl 2010;2:31–34.
37. Speech Pathology Australia. Telepractice in speech pathology position statement. Melbourne, Australia. 2014. Available at: http://www.speech pathologyaustralia.org.au. Accessed September 15, 2016.
38. Pepritz JD, Beaumont JL, Bode R, Cella D, Garcia SF, Halm EA. Development and validation of the functional assessment of chronic illness therapy treatment satisfaction (FACIT TS) measures. Qual Life Res 2014;23:815–824.