

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/336690058>

Impact of school-based allied health therapy via telehealth on children's speech and language, class participation and educational outcomes

Article in *Journal of Telemedicine and Telecare* · October 2019

DOI: 10.1177/1357633X19875848

CITATIONS

3

READS

573

5 authors, including:



Liam Caffery

The University of Queensland

88 PUBLICATIONS 950 CITATIONS

[SEE PROFILE](#)



Monica Taylor

The University of Queensland

19 PUBLICATIONS 122 CITATIONS

[SEE PROFILE](#)



D. G. Theodoros

The University of Queensland

234 PUBLICATIONS 3,637 CITATIONS

[SEE PROFILE](#)



Anthony C Smith

The University of Queensland

202 PUBLICATIONS 2,880 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Indigenous Ear Health [View project](#)



Dementia ECHO [View project](#)

Impact of school-based allied health therapy via telehealth on children's speech and language, class participation and educational outcomes

Journal of Telemedicine and Telecare
2019, Vol. 25(9) 559–565
© The Author(s) 2019
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/1357633X19875848
journals.sagepub.com/home/jtt


Danette H Langbecker¹ , Liam Caffery¹ , Monica Taylor¹,
Deborah Theodoros² and Anthony C Smith^{1,3} 

Abstract

Introduction: Access to telehealth services for children living in rural and remote areas of Australia is very limited. The delivery of allied health therapies to children in school via telehealth may help reduce inequality and improve academic outcomes over time.

Methods: A service delivering speech and language therapy (SLT) and occupational therapy (OT) via videoconferencing to children at five rural schools was prospectively evaluated. Each child's teacher rated their speech and language, participation in class and educational outcomes at the beginning and end of semester. Change in the summative teacher-rating index over the first and subsequent semesters in which a child received therapy was examined. Independent predictors of change were identified using multivariable linear regression.

Results: Over two years, 1029 sessions of SLT and 531 sessions of OT were delivered to 98 children (67% male, 38% in Prep at commencement) via telehealth. In their first semester of therapy, 57 children received SLT, 37 OT and four both therapies. The mean teacher-rating index significantly improved from the beginning (35.05 ± 10.68) to end (40.02 ± 11.75) of the first semester of therapy ($p < 0.001$). In multivariable linear regression, grade, school and baseline rating were significantly associated with the end-of-semester teacher-rating index.

Discussion: Delivering allied health therapy by videoconference may enable children to better engage with schooling. Differences in improvements by grade suggest improvements may be maximised by targeting therapy at certain year levels. This model may be useful in areas with limited access to allied health services.

Keywords

Child, speech therapy, occupational therapy, academic performance, telehealth, telemedicine

Date received: 24 July 2019; Date accepted: 13 August 2019

Introduction

People living in rural and remote areas/regions of Australia experience reduced access to a broad range of specialist health services compared to their urban counterparts, mainly due to the logistical challenges of travel to city locations.¹ Conventional health services typically require travel to a specialist, which may result in hours of commuting for a very brief appointment. Alternative service delivery models – such as visiting outreach programs and telehealth – offer people the opportunity to access services closer to home.² In the case of allied health services, access to speech and language therapy (SLT) and occupational therapy (OT) for children in rural areas is very limited, yet the

demand remains very high. The delivery of telehealth services into the classroom has been shown to be feasible and acceptable.^{3–5}

¹Centre for Online Health, The University of Queensland, Brisbane, Australia

²School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia

³The University of Southern Denmark, Odense, Denmark

Corresponding author:

Danette H Langbecker, Centre for Online Health, The University of Queensland, Building 33, Princess Alexandra Hospital, Woolloongabba, QLD, 4102, Australia.

Email: d.langbecker@uq.edu.au

The Health-e-Regions project commenced in 2012 with the primary aim to expand the use of telehealth within the Western Downs region of Queensland. Initially, the focus was on a broad range of telehealth services for patients of all ages and in a variety of settings such as hospitals, general practice and nursing homes.^{6,7} In 2015, the focus of the project was directed towards schools in the region and the expressed need for telehealth services (especially SLT) among school-aged children. Following a successful pilot phase involving SLT, the project was expanded to deliver SLT and OT to five schools across four towns in the region.⁸

Children with untreated therapy needs are known to experience a range of consequences, including poorer educational, psychological and social outcomes as they get older.^{9,10} Some studies have demonstrated the validity of and satisfaction with telehealth services in the context of speech and language development.^{11–13} A systematic review of studies describing the efficacy of telerehabilitation services for primary-school-aged children showed limited but promising evidence, but also reported that most studies involved adult participants rather than children.¹⁴ In the USA, a study that used iPads to deliver SLT into schools showed that children involved in the telehealth program were more likely to achieve therapy goals associated with language skills than those related to speech.¹⁵ The expansion of the Health-e-Regions program provided a further opportunity to examine the impact of school-based telehealth

services not only on speech and language ability, but also on participation and social outcomes.

This study aimed to quantitatively address the following research question: what is the impact of speech and language and occupational therapy delivered by telehealth into a school on children's speech and language outcomes, participation in class activities and educational outcomes?

Methods

Service model

The telehealth service offered SLT and OT via videoconferencing to children at five rural Queensland schools teaching at least grades Prep (the first year of schooling in Queensland) to grade six. The service model and evaluation design are shown in Figure 1. At the beginning of each semester, children were chosen for participation in SLT and/or OT via telehealth following local processes at each school, including identification of problems, assessment for suitability and consent by parent/guardian. Selection was not by formal clinical diagnosis; however, some children may have had a prior diagnosis of a speech/language disorder. Therapy was delivered to children individually in weekly sessions over 12 weeks accompanied by a teacher aide or equivalent at the child's school, by final-year undergraduate allied health students from The University of Queensland Telerehabilitation Clinic

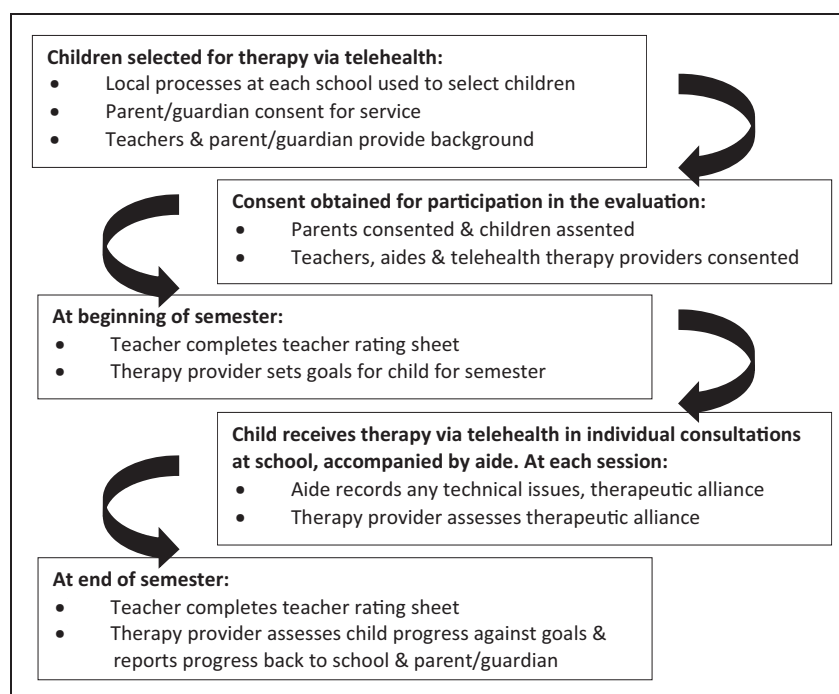


Figure 1. Service model and evaluation design.

under the supervision of clinical educators. Telehealth sessions were conducted using iPad Air devices (Apple, Cupertino, CA, USA) using eHAB telerehabilitation software (NeoRehab, Brisbane, Australia) and/or room-based videoconferencing equipment, depending on the preferences of the school. School staff coordinating the program were trained in equipment use and troubleshooting. No restrictions were placed on children receiving therapy in person through the school and/or private providers.

Study design and data collection

A prospective evaluation study was conducted of the service over a two-year period. The study received ethical approval from The University of Queensland Human Research Ethics Committee (#2016001116) and the schools and educational systems involved. Both quantitative and qualitative data were collected from multiple perspectives to allow triangulation of findings. This article reports findings related to the primary research question; additional findings will be reported subsequently. Consent for participation in the evaluation was independent of and not required for participation in the service.

The primary study outcome measure was a classroom teacher rating of a child's speech and language abilities, educational outcomes and participation in class. As no suitable validated instrument to measure these outcomes could be identified, a study-specific tool was developed using an online Delphi panel process involving three rounds. In the first round, participants suggested items for the tool; in subsequent rounds, they rated and then ranked the items in terms of their usefulness, with the aim of achieving a consensus on the most useful items with which to assess the impact of allied health therapies on school-related behaviour and outcomes. Nine teachers and therapists involved in the establishment of the therapy program participated, resulting in a tool containing 10 items (Box 1). Teachers completed the teacher rating form at the

beginning and end of each semester in which a child received therapy via telehealth, with each item scored on a seven-point Likert-type scale from 'poor/not at all' to 'excellent'. Teachers also used this form to report if the child received therapy in person over the course of the semester.

Additional data reported herein were collected by allied health therapy providers. As therapeutic alliance, or the collaborative relationship between therapist and therapy recipient, may impact on child outcomes,¹⁶ allied health therapy providers completed two questions at the completion of each therapy session: 'In this session, how engaged (on task) was the child?' (engagement) and 'How much did the child enjoy this session?' (enjoyment), rating each on a five-point scale. Data routinely collected as part of normal service delivery by The University of Queensland Telerehabilitation Clinic, such as child demographics (age, grade) and type of therapy delivered, were also reviewed.

Data analyses

Descriptive statistics were used to report the sample and services delivered. Scores on the teacher rating scale were combined into a summative index, with missing data imputed as the mean of the other items, provided at least 80% of items were completed. The internal consistency of the resultant scale was acceptable (Cronbach's alpha 0.884–0.949 at each time point).¹⁷ Measures of engagement and enjoyment for each child over the course of each semester were summarised using means and standard deviations (SDs). As children could receive therapy via telehealth for up to four semesters, and to account for clustering by child, teacher-rating index data were not combined across semesters. Furthermore, it was expected that children receiving therapy across multiple semesters may differ from those receiving fewer semesters of therapy. Thus, analyses were stratified by the semester of therapy, defined as the first, second, third or fourth

Box 1 Items rated by teachers on a seven-point Likert-type scale at the beginning and end of semester for each child who received telehealth therapy.

1. Student is confident to express themselves orally in a variety of situations
2. Student can speak in complete sentences
3. Student has an appropriate vocabulary for their age
4. Student pronounces sounds and words well
5. Student can communicate with peers
6. Student understands verbal instructions easily
7. Student participates and engages in class
8. Student can communicate effectively so that they can be understood
9. Student demonstrates age-appropriate social skills
10. Student follows multi-step directions

semester in which a child received therapy (regardless of the time period in which the therapy was delivered).

Multivariable linear regression was used to assess change in the teacher-rating index from the beginning to the end of the first semester in which children received therapy, and to identify independent predictors of change. Possible relationships between demographics (sex, grade, school), therapeutic alliance (engagement, enjoyment), therapy received (type and volume of telehealth therapy, receipt of in-person therapy) and teacher-rating index were explored using correlations, repeated measures *t*-tests and analysis of variance (ANOVAs) and the Welch test (when assumptions of homogeneity of variances were not met with the ANOVA), with variables significant at the bivariate level entered into the regression model. Similar analyses were used to assess change over subsequent semesters of therapy, although smaller numbers of children receiving multiple semesters of therapy limited the ability to identify predictors. Predictors of change are reported for the first semester of therapy only. Statistical significance was set at $p < 0.05$.

Results

Over the two years, 1560 sessions of therapy (1029 sessions of SLT and 531 sessions of OT) were delivered to 98 children via telehealth. Approximately two-thirds of the children were male, and most were in Prep or grade one at the time of their first semester of therapy (Table 1). While 57% of children received SLT via telehealth and 38% OT alone via telehealth, five children received both SLT and OT via telehealth, either concurrently or in different semesters. Just under half of the children (47%) received therapy via telehealth in one semester only; only 9% of the sample received therapy via telehealth across all four semesters. Approximately 17% of children received in-person SLT and 6% in-person OT in the child's first semester of therapy.

Impact on child speech and language, educational outcomes and participation in class

A teacher-rating index could be calculated at both the beginning and end of semester for 173 of 182 semesters of therapy delivered. Forty-eight teachers provided ratings for the 98 children. The mean teacher-rating index significantly improved from the beginning (35.05, SD 10.68) to the end (39.79, SD 11.77) of the first semester of therapy received ($R^2=0.563$, $F(1, 92)=120.924$, $p < 0.001$). Mean scores similarly improved in subsequent semesters of therapy (Table 2).

Predictors of improvement

Further analyses were conducted to identify possible independent predictors of change in mean teacher ratings over the first semester of therapy. Bivariate analyses identified that the teacher-rating index at the end of semester significantly varied by grade (Welch's $F(4, 37.471)=4.028$, $p=0.008$), school ($F(4, 91)=3.320$, $p=0.014$), receipt of in-person OT ($t(94)=-2.384$, $p=0.019$) and beginning-of-semester teacher-rating index (paired $t(93)=-5.884$, $p < 0.001$). When these variables were added to the regression, the model explained 65.0% of the variance ($R^2=0.650$, $F(15, 78)=12.498$, $p < 0.001$). The beginning-of-semester teacher-rating index significantly predicted the end-of-semester value ($\beta=0.751$, $p < 0.001$). Significant differences were also seen within some categories of both grade and school, as shown in Figure 2. Compared to children attending School A, children attending School C and School D had significantly higher teacher-rating index scores at the end of semester, controlling for start-of-semester scores ($\beta=0.165$, $p=0.033$ and $\beta=0.233$, $p=0.023$, respectively). No significant differences were seen for schools B and E. Compared to children in Prep, children in grade two had a significantly higher teacher-rating index score at the end of semester, controlling for their start-of-semester score ($\beta=0.210$, $p=0.005$). No significant differences were seen for other grades, and no other variables in the model were significant.

Discussion

This research demonstrates some of the benefits of telehealth services for children, from the perspective of the classroom teacher. The majority of children who received telehealth services (SLT and OT) through the Health-e-Regions program showed consistent improvement over time. According to teacher ratings of students at the beginning and end of each semester, speech and language skills, educational outcomes and participation in class had all improved. These positive changes were sustained in the children who received therapy services over multiple semesters.

The results of this study also indicated some variations in improvement of the children involved in the program. Whilst it is important to note that improvements were seen overall, when the average rating per child was compared by school, variations were observed. We also found that the children most responsive to the program were those in Grade 2 (approximate age seven years), compared to children in other grades. These observations warrant further investigation to determine whether factors such as the child's age, their level of speech and language development during the program and the schools' administration

Table 1. Characteristics of children receiving services via telehealth.

Characteristics of children across the two years of the program			Characteristics of children in their first semester of therapy via telehealth		
Characteristic	<i>n</i>	%	Characteristic	<i>n</i>	%
School			Grade		
A	27	27.6%	Prep	37	37.8%
B	19	19.4%	1	17	17.3%
C	10	10.2%	2	15	15.3%
D	24	24.5%	3	13	13.3%
E	18	18.4%	4–6	16	16.3%
Type of therapy received by telehealth ^a			Type of telehealth therapy received		
SLT	56	57.1%	SLT	57	58.2%
OT	37	37.8%	OT	37	37.8%
Both	5	5.1%	Both	4	4.1%
Gender			Received in-person therapy		
Female	32	32.7%	SLT	17	17.3%
Male	66	67.3%	OT	6	6.1%
Number of semesters of therapy via telehealth received			Number of sessions of therapy via telehealth received – median (range) ^b		
1	46	46.9%	Total	9 (1–21)	
2	29	29.6%	SLT	9 (2–10)	
3	14	14.3%	OT	9 (1–12)	
4	9	9.2%	Therapeutic alliance ^c – mean (SD)		
Total number of telehealth sessions – mean (SD)	15.92 (10.0)		Enjoyment	3.95 (0.51)	
			Engagement	3.98 (0.57)	

SD: standard deviation; SLT: speech-language therapy; OT: occupational therapy.

^aType of therapy received by telehealth across entire program; children may receive SLT and OT in concurrent or consecutive semesters.

^bNumber of sessions of therapy via telehealth calculated for SLT and OT only for children who received that therapy type via telehealth in their first semester of telehealth therapy; median (range) reported as data skewed.

^cTherapeutic alliance as rated by allied health therapist; reflects mean rating across all sessions of a child's first semester of telehealth therapy.

Table 2. Change in mean teacher ratings from beginning to end of semester in children's first and subsequent semesters of therapy received by telehealth.

Semester of therapy	Number of children who received therapy	Mean (SD) number of consultations	Mean (SD) teacher rating				P-value for difference ^b
			<i>n</i> ^a	Beginning of semester	<i>n</i> ^a	End of semester	
First	98	8.67 (3.27)	96	35.05 (10.68)	96	40.02 (11.75)	<0.001
Second	52	8.65 (2.74)	52	36.15 (10.99)	48	44.08 (11.29)	<0.001
Third	23	7.87 (2.20)	23	37.91 (11.36)	22	42.00 (9.88)	0.001
Fourth	9	8.78 (1.09)	9	38.67 (7.97)	9	44.78 (11.26)	0.002

SD: standard deviation.

^aNumber of children for whom teacher rating data was available.

^bP-value for linear regression with beginning of semester rating as covariate.

of the program (dedicated teaching resources, alignment with classroom activities and coordination of sessions) are directly related to performance outcomes.

Previous work by researchers in the USA demonstrated similar outcomes when comparing SLT services delivered in person and by telehealth. Interestingly, while children receiving therapy in either model showed significant improvements overall, there were no significant differences between the two modalities

on individual education goals.¹⁸ These findings are consistent with a recent systematic review,¹⁴ which showed (in only a small selection of articles, *n* = 7) promising evidence to support the efficacy of telehealth for the delivery of SLT services to school-age children. Our study provides further evidence to support the delivery of SLT telehealth services in the school environment, by demonstrating positive outcomes related to goal attainment, classroom participation and educational

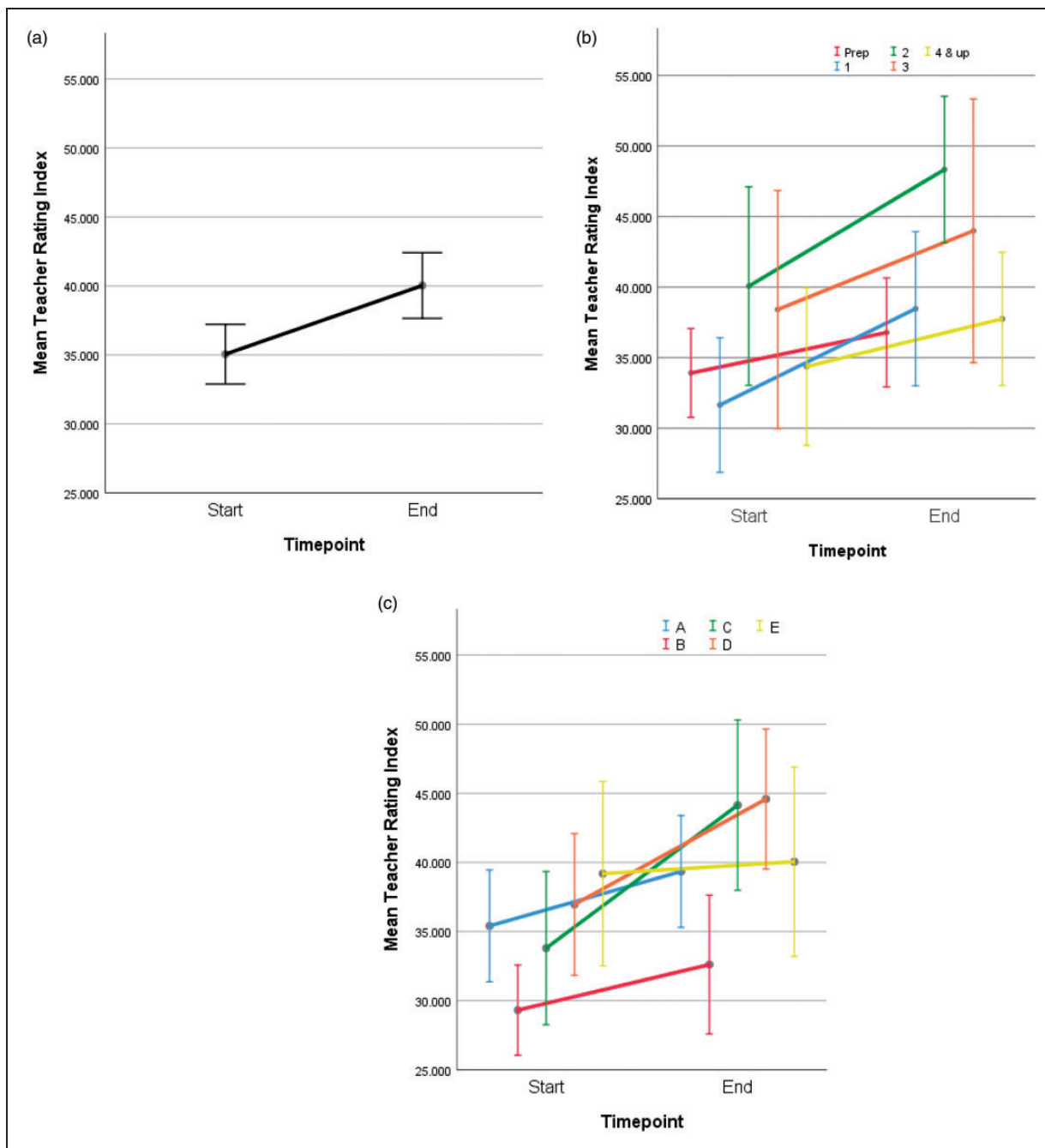


Figure 2. Change in teacher-rating index scores from start to end of the first semester in which children ($n = 98$) received telehealth therapy, overall and by sub-groups. (a) All children; (b) by grade; (c) by school. Error bars represent 95% confidence intervals.

outcomes over time. We also describe the use of a novel teacher-rating scale, which was developed for the reporting of outcomes associated with this study.

Limitations

Our study has some limitations. First, since there was no validated teaching-rating scale, we had to develop our own for the study. This instrument needs

further validation, but has proven useful for the assessment of a child's performance in the school setting. Second, there may be a perceived risk of bias because teachers reported on the child's outcomes. Third, we did not compare performance outcomes of children receiving therapy using different modalities (such as in person). This was impractical, since there remains very limited capacity to deliver the same services in person.

Conclusion

Delivering allied health therapy by videoconference seems to have positive benefits on a child's ability to better engage with schooling. Differences in improvements by grade suggest improvements may be maximised by targeting therapy at certain year levels. This model may be useful in other communities where access to allied health services is limited.

Acknowledgements

We wish to thank the staff, children and families who participated in this study. We also thank the speech pathology and occupational therapy students who provided the service and the clinical educators who supported them; and Ruth Taylor and Lisa Garner for their roles in establishing and managing the Health-e-Regions project. We also thank Associate Professor Jason Ferris for providing statistical advice. We appreciate the support of Shell-QGC who fund the Health-e-Regions project.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: this research was conducted with the support of the Centre of Research Excellence in Telehealth funded by Australia's National Health and Medical Research Council (NHMRC; grant number APP1061183) and the Health-e-Regions program funded through Shell QGC. The contents of the published material are solely the responsibility of the individual authors and do not reflect the views of NHMRC or other funding agencies.

ORCID iD

Danette H Langbecker  <https://orcid.org/0000-0002-6964-2912>

Liam Caffery  <https://orcid.org/0000-0003-1899-7534>

Anthony C Smith  <https://orcid.org/0000-0002-7756-5136>

References

- Smith AC and Gray LC. Telemedicine across the ages. *Med J Aust* 2009; 190: 15–19.
- Moffatt JJ and Eley DS. The reported benefits of telehealth for rural Australians. *Aust Health Rev* 2010; 34: 276–281.
- Scheidman-Miller C, Clark PG, Smeltzer SS, et al. Two year results of a pilot study delivering speech therapy to students in a rural Oklahoma school via telemedicine. In: Proceedings of the 35th annual Hawaii international conference on system sciences (HICSS-35 02), Big Island, HI, 10 January 2002. IEEE. DOI: 10.1109/HICSS.2002.994136.
- Rose DAD, Furner S, Hall A, et al. Videoconferencing for speech and language therapy in schools. *BT Technol J* 2000; 18: 101–104.
- Molini-Avejonas DR, Rondon-Melo S, Amato CAdLH, et al. A systematic review of the use of telehealth in speech, language and hearing sciences. *J Telemed Telecare* 2015; 21: 367–376.
- Croll J, Norton CJ, Gray LC, et al. Telehealth opportunities in regional Queensland: a scoping study. *J Telemed Telecare* 2012; 18: 451–454.
- Smith AC, Caffery LJ, Saunders R, et al. Generating new telehealth services using a whole of community approach: experience in regional Queensland. *J Telemed Telecare* 2014; 20: 365–369.
- Bradford NK, Caffery LJ, Taylor M, et al. Speech-language pathology services delivered by telehealth in a rural educational setting: the school's perspective. *J Int Soc Telemed EHealth* 2018; 6: 1–8.
- Wallace IF, Berkman ND, Watson LR, et al. Screening for speech and language delay in children 5 years old and younger: a systematic review. *Pediatrics* 2015; 136: e448–e462.
- Johnson C, Beitchman J and Brownlie E. Twenty-year follow-up of children with and without speech-language impairments: family, educational, occupational, and quality of life outcomes. *Am J Speech Lang Pathol* 2010; 19: 512–565.
- Taylor OD, Armfield NR, Dodrill P, et al. A review of the efficacy and effectiveness of using telehealth for paediatric speech and language assessment. *J Telemed Telecare* 2014; 20: 405–412.
- Fairweather GC, Lincoln MA and Ramsden R. Speech-language pathology teletherapy in rural and remote educational settings: decreasing service inequities. *Int J Speech Lang Pathol* 2016; 18: 592–602.
- Fairweather GC, Lincoln M and Ramsden R. Speech-language pathology telehealth in rural and remote schools: the experience of school executive and therapy assistants. *Rural Remote Health* 2017; 17: 4225.
- Wales D, Skinner L and Hayman M. The efficacy of telehealth-delivered speech and language intervention for primary school-age children: a systematic review. *Int J Telerehabil* 2017; 9: 55–70.
- Isaki E and Farrell C. Provision of speech-language pathology telepractice services using Apple iPads. *Telemed J E Health* 2015; 21: 538–539.
- Cole MB and McLean V. Therapeutic relationships redefined. *Occup Ther Ment Health* 2003; 19: 33–56.
- Tavakol M and Dennick R. Making sense of Cronbach's alpha. *Int J Med Educ* 2011; 2: 53–55.
- Grogan-Johnson S, Gabel RM, Taylor J, et al. A pilot exploration of speech sound disorder intervention delivered by telehealth to school-age children. *Int J Telerehabil* 2011; 3: 31–42.