Research Article

The complex care guide: Piloting a mobile application as a just in time educational tool for pediatricians caring for children with medical complexity

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ABSTRACT

Pediatricians report not having adequate knowledge or time to provide quality care for children with medical complexity. We developed a web based application, the complex care guide, to house best practices in tracheostomy care, gastrostomy care, and caregiver support and measured its use over a 90 day period in a pilot group of pediatricians. The application was accessed 187 times during the pilot by 105 users, 24 of which were repeat users and over half of the users viewed multiple pages during a visit. The application continued to be accessed at one and two years after the pilot. We were unable to determine if there was an increase in knowledge of best care practices for children with medical complexity from interacting with our application. This pilot study suggests that web-based applications are an accessible mode of information delivery for practicing pediatricians.

Keywords: Children with medical complexity, Tracheostomy, Gastrostomy, Caregiver support, Advance care planning, Mobile application

INTRODUCTION

Children with Medical Complexity (CMC) are a small but growing subset of the pediatric population who have substantial unmet health care needs, suffer from substandard quality of care, and incur high levels of health care spending [1]. Over the last decade, many healthcare systems and academic institutions have explored ways to improve the quality of care and contain costs for CMC such as preventing hospitalization, streamlining transitions of care, and establishing integrated care management models [2-4]. Primary Care Providers (PCPs), usually pediatricians, play an important part in many of these emerging best care practices. PCPs have reported that patients' complexity, high needs of caregivers, and limited time with CMC patients are barriers to providing optimal care [5]. A needs assessment of community pediatricians affiliated with our large, urban, academic children's hospital was conducted to determine their formal training, perceived fund of knowledge, experience, and level of comfort in twelve domains of caring for children with medical complexity (unpublished data). The results indicated that community pediatricians affiliated with

our institution had the lowest self-reported training, knowledge, and experience in managing tracheostomies, managing aggressive behavior in non-verbal patients, determining need for private duty nursing hours, and screening for caregiver fatigue. It was also determined that (lack of) time was considered the biggest barrier to providing appropriate care for CMC in the community setting.

There have been targeted educational interventions for healthcare trainees in the area of caring for CMC, however, there are few focused on educating practicing pediatricians. Our aim was to create an accessible educational tool for pediatricians caring for CMC to increase their knowledge in this area [6].

METHODOLOGY

Study design

Based on the results of the needs assessment, the authors chose to focus on tracheostomy care, gastrostomy care, and family

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support with subheadings of routine care and troubleshooting (for tracheostomy and gastrostomy care) and determining home nursing need, screening for caregiver fatigue, and advance care planning (for caregiver support). A literature search was conducted in PubMed and Googlescholar to ascertain guidelines and current best practices in each of these areas. The content was curated and reviewed by members of our study team (physicians, nurse practitioners, and researchers) who have expertise in the fields of pediatric complex care and/or pediatric palliative care.

Determining the instructional method: Given that (lack of) time was cited as the primary barrier in community pediatrician's providing care to CMC, a teaching format that is precise to the learning need and accessible in the learning moment was sought.

Bioscience theories such as cognitive theory of multimedia learning and cognitive load theory suggest that multi-media learning can optimize retention and performance in practice as the brain is free to learn only what is needed and not superfluous information. Likewise, according to adult learning theory and situated learning theory, the role of self directed learning and incorporating workplace features into educational design are associated with positive learner experience and material retention [7,8]. A multimedia curriculum of text, photographs, diagrams, and tables was created with indexed links to individual topics and hyperlinks to resources. The domain "complexcareguide.com" was purchased and the website was developed in word press with support from information technology specialists. The website had unrestricted access.

Pilot and assessment: The three pediatric primary care clinics affiliated with our hospital system with the highest percentage of CMC patients were selected to pilot the mobile application (total of 30 pediatricians). Orientation was conducted in person by the authors who introduced the complex care guide to the pilot participants and taught them how to navigate the application. Initial usage of the application was tracked *via* Google Analytics over a 90-day period and follow up data were collected for 90 day periods one year and two years after the pilot.

Real time feedback was elicited during each usage of the app on whether or not the information accessed was helpful through a one click "yes/no" hard stop before the user could exit the application.

After 90 days, the learners were sent surveys assessing their satisfaction with the app as a learning tool and their knowledge of caring for CMC. The survey was created *de novo* by the study team in survey monkey and consisted of 10 questions scored on a liker scale of 1-5, with increasing numbers reflecting increasing satisfaction or knowledge. The three questions relating to the learner's knowledge in tracheostomy care, gastrostomy care, and caregiver support were compared to the same questions in the needs assessment. Mean responses were compared using Mann-Whitney tests.

RESULTS

App usage: The app usage statistics during the pilot and at one and two years are presented in Table 1. "Sessions" represents every visit to the application website, "user" is an individual device (smart phone, desktop computer, laptop computer, or tablet) that visits the website, and "return user" is a device that has visited the site multiple times of the users, 75% accessed the app *via* their mobile devices, the remainder *via* a desktop or laptop computer. All uses occurred between 7 am and 7 pm, Central Standard United States Time.

Table 1. The Complex Care Guide (complexcareguide.com) site analytics over a 90-day period in 2019, 2020, and 2021.

Site analytics	2019	2020	2021
Sessions	187	52	101
Users	105	46	88
Return users	24 (23%)	5 (10%)	7 (8.5%)
Bounce rate*	49%	90%	78%
Sessions per user	1.8	1.1	1.1
Pages per session	5.4	1.4	1.8
International users	7 (6.7%)	8 (17.4%)	20 (22.7%)

DISCUSSION

Learner feedback of the 105 initial users of the app, 92% reported the information was helpful *via* the real time, in application question.

In the needs assessment survey (N=29), mean self reported scores of knowledge in tracheostomy care, gastrostomy care, and caregiver supports were 2.5, 2.8, and 2.5, respectively. Ninety day post implementation surveys (N=4) reported mean scores of 3.3, 3.7, and 3.7.There was no significant difference between the mean scores of the two groups results when

compared in the three areas. The mean score of the post implementation survey question related to ease of use was 4.3.

CONCLUSION

This pilot study suggests that a mobile application containing learning resources for pediatricians caring for CMC may be a useful learning tool as evidenced by the high real time rating of the learners, multiple visits by some users and multiple pages visited in most sessions. Importantly, pediatricians used this educational tool during business hours and mostly from their mobile devices, which supports its accessibility and possible integration into clinical practice.

Usage of the complex care guide continued at one and two years after the pilot, although with fewer and with shorter visits and more international use. This suggests less use by the pilot participants and more use by random "hits" from internet searches. Given the small number of feedback surveys collected at 90 days during the pilot, we are unable to determine if the pediatricians increased their knowledge how to care for CMC by using the application.

Our study is limited by the small number of feedback surveys received at 90 days and the inability to link the user of the app to the analytics. Although research on the extent of utilization and efficacy of mobile applications in medical education is limited, other, similar sectors show growth in using mobile applications as an instructional method and encourage its development [9,10]. This pilot study suggests that a mobile application containing best practices in caring for CMC is an accessible way to deliver just-in-time education to pediatricians, although its impact on learner knowledge remains unclear.

Future directions include defining a process for content update and site maintenance, user expansion to possibly include home health nurses and caregivers, and evaluating the clinical impact of the complex care guide.

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