Journal of Pediatric Nursing (2014) **29**, 198–204

Impact of Telemedicine in Managing Type 1 Diabetes Among School-age Children and Adolescents: An Integrative Review

Rebecca Guljas MSN, CPNP*, Azza Ahmed DNSc, IBCLC, CPNP, Karen Chang PhD, Analei Whitlock MSN, CPNP

Purdue University, West Lafayette, IN, USA

Received 17 April 2013; revised 21 October 2013; accepted 25 October 2013

Key words:
Telemedicine;
Pediatrics;
School-age children;
Adolescents;
Type 1 diabetes

Patients with diabetes who have limited access to healthcare services are less likely to maintain adequate diabetes control. Telemedicine represents a useful solution to the strict follow up required in diabetes management. This review analyzes the impact that telemedicine has on the management of type 1 diabetes among school-age children and adolescents, as measured by compliance with blood glucose monitoring, glycemic control, satisfaction, and self management. In general, this review supports the use of telemedicine in maintaining glycemic control. Further studies are desired to observe the impact of telemedicine in managing type 1 diabetes in school-age children and adolescents.

Background

APPROXIMATELY 25.8 MILLION individuals in the United States have diabetes, roughly 215,000 of which are under the age of 20 years (American Diabetes Association [ADA], 2011). Each year more than 13,000 young people are diagnosed with type 1 diabetes (Centers for Disease Control and Prevention [CDC], 2012). Maintaining glycemic control is essential in diabetes management to prevent future complications (ADA, 2011). However, diabetes management is often difficult among children and adolescents due to peer influences, shifts in responsibility, risk taking behaviors, lack of diabetes knowledge, fatigue with disease management, lack of motivation, disordered eating, and physiological changes that lead to greater insulin resistance (Borus & Laffel, 2010; Curtis & Hagerty, 2002; Petitti et al., 2009). According to The SEARCH for Diabetes in Youth Study, poor glycemic control (HbA1c >9.5) was found in 17% of youth with type 1 diabetes (Petitti et al., 2009).

* Corresponding author: Rebecca Guljas, MSN, CPNP.
E-mail address: rguljas@gmail.com.

0882-5963/$ – see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.pedn.2013.10.013

Poor access to healthcare leads to additional challenges when managing children and adolescents with diabetes. Healthcare access plays a significant role in the health status and quality of life for diabetic patients. Patients with diabetes who have limited access to healthcare are less likely to maintain adequate diabetes control and have an increased risk of developing complications, which can be detrimental in youth with diabetes (Vachon et al., 2007). Telemedicine has been gaining recognition in recent years for improving healthcare access and healthcare services (Agency for Healthcare Research and Quality [AHRQ], 2008). Telemedicine is defined as the use of telecommunications to deliver healthcare services by the following methods: provider to provider with the patient present, which involves the remote interaction between a primary care provider and specialist; provider to provider without patient present, which includes the transmission of health information from one provider to another; telemonitoring, or the transmission of health data from the patient's home to the provider; and the transmission of health education, such as lectures or computer-based training programs, via intranet or other telecommunications (AHRQ, 2008). Telemedicine represents a useful and cost-effective

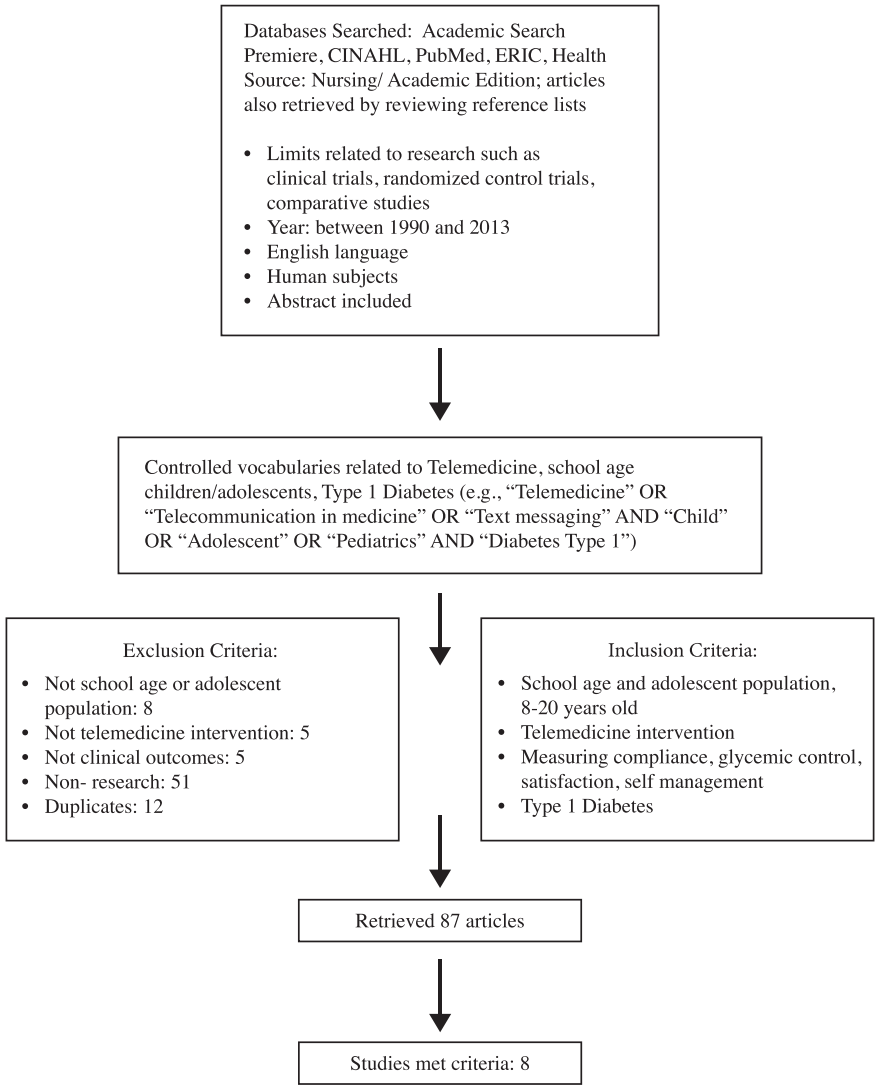

Figure 1 Search strategies and review process.

solution to the strict follow-up required in diabetes management (Montani, Bellazzi, Quaglini, & d'Annunzio, 2001).

A review of the literature revealed five systemic reviews and meta-analyses of telemedicine in the management of diabetes (Farmer, Gibson, Tarassenko, & Neil, 2005; Montani et al., 2001; Montori et al., 2004; Russell-Minda et al., 2009; Shulman, O'Gorman, & Palmert, 2010). Of these reviews, three reported that telemedicine interventions were not effective in improving glycemic control (Farmer et al., 2005; Montori et al., 2004; Shulman et al., 2010). However, the review by Montani et al. (2001) indicated a significant improvement in HbA1c. In addition, there are a lack of literature reviews related to the school-age children and adolescents with type 1 diabetes. Thus, there is a need for an integrated literature review to examine the impact of telemedicine on diabetes self-management among school-age children and adolescents.

This integrative review evaluated the impact of telemedicine programs in managing type 1 diabetes among school-age children and adolescents, by measuring compliance with blood glucose testing, glycemic control, patient or parent satisfaction, and self-management. Compliance with blood glucose testing represents the frequency of blood glucose self-monitoring in patients. Glycemic control includes HbA1c, individual blood glucose values, and the incidence of complications such as diabetic ketoacidosis and hypoglycemia. Patient and parent satisfaction is measured by self-reported satisfaction scores. Self-management involves patient or parent perception of ability to use telemedicine in the management of diabetes. Together these outcomes represent the patient's involvement and satisfaction with their diabetes management and overall risk of developing future complications.

Methods

A comprehensive literature search was conducted using the following databases: PubMed, Academic Search