THE IMPACT OF NARRATIVE MESSAGES ON ADOLESCENTS' TYPE 1 DIABETES MANAGEMENT

Trevor Bell

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Media and Journalism.

Chapel Hill
2019

Approved by:

Seth M. Noar

Daniel Riffe

Autumn Shafer

Allison Lazard

Nina Jain

ABSTRACT

TREVOR BELL: The impact of narrative messages on adolescents' type 1 diabetes management
(Under the direction of Seth M. Noar, Ph.D.)

Type 1 diabetes (T1D) is a chronic, lifelong illness that requires constant and continual self-management. For adolescents ages 12-17, however, self-management is a daunting task and many struggle to control their disease. To address this, the current dissertation developed and evaluated narrative messages to improve adolescents' T1D management. Aim 1 of this dissertation was a two-phase formative research study that created and pretested narrative messages about self-management targeting adolescents with T1D. The messages were based on true stories from college students with T1D who described the struggles they went through in adolescence and what steps they took to improve their T1D management. The first phase of Aim 1 consisted of interviewing college students who have T1D (*n* = 6) to develop five messages. Specific narrative topics included T1D acceptance, social support, hospitalizations due to high blood sugar, food intake, and low blood sugar. In the second phase of Aim 1, adolescents ages 12-17 with T1D (*n* = 8) evaluated the narrative messages and offered feedback through semi-structured interviews and perceived message effectiveness (PME) ratings. Participants rated the narrative messages favorably, perceiving them as personally relevant, motivational, and effective for getting adolescents to take better control of their T1D. Aim 2 was an online experiment involving adolescents with T1D (*N* = 191) who were randomized to view either three narrative messages or three standard of care messages. Narrative messages were those developed in Aim 1, and standard of care messages were adapted from materials used by a high-ranking pediatric endocrinology clinic and addressed basic T1D management. The online experiment evaluated the impact of the set of narrative messages on message evaluation and psychosocial outcomes, compared to the set of standard of care messages. Results showed that there were no significant differences on any outcomes based on message type; however, mean scores were high for both conditions, suggesting that both types of messages might offer useful advice and guidance for adolescents with T1D. Discussion and future directions focus on the fact that narratives could work well in conjunction with standard of care messages to target different aspects of T1D management, such as how to best manage (standard of care) and why to successfully manage (narratives) T1D. This dissertation worked with an understudied, hard-to-reach population and illustrated how narratives could be developed and tested using a systematic approach that contributes to effective management of T1D among adolescents.

ACKNOWLEDGMENTS

Countless individuals, families, organizations, and dogs have influenced my success in this doctoral program and this dissertation. I am grateful for all the support, encouragement, understanding, and, ultimately, challenges that have been presented to me throughout this entire process. I am thankful to the faculty, staff, and fellow graduate students at the School of Media and Journalism at the University of North Carolina at Chapel Hill. I received an exemplary education from this school and university, and I am forever proud to be a Tar Heel.

I would like to thank my advisor – Dr. Seth M. Noar – and the rest of my doctoral committee – Drs. Daniel Riffe, Autumn Shafer, Allison Lazard, and Nina Jain.

Seth – You have been an inspiration to me and without your guidance, none of this would be possible. You have constantly pushed me, and I cannot thank you enough for all the support you have shown in my research and goals to help those living with type 1 diabetes. You have made me the scholar that I am today.

Dr. Riffe – I enjoyed every class you taught, and I thank you for challenging me to think deeper and create my own niche with my research. You always provided me with different approaches to my work, as well as guided me to better solutions.

Dr. Shafer – It has been an absolute honor to continue working with you and continuing the work we started when you were my advisor in my master's program at Texas Tech University. You have always been a pillar of support, and I appreciate the level of care and commitment you have shown throughout my entire academic career.

Allison – Every interaction with you has been a positive one, and without your help, this experiment could not have been possible. I always felt uplifted and encouraged after speaking with you. Thank you for the positive energy that has propelled me through this program.

Nina – You have been truly wonderful, especially with helping recruit participants and understanding how my research can positively affect the work you do in the endocrinology clinic. It was a privilege to see you interact with your patients, and I saw that same level of care when you worked with me.

To this point, I would also like to thank the pediatric endocrinology team at the University of North Carolina Children's Hospital who helped with recruitment and offered advice for my research. This includes Katie Cooper, Michelle Curl, Lauren Kager, and Drs. Ali Calikoglu, Amy Levenson, Jennifer Law, Elizabeth Estrada, and Beth Sandberg. Without your help, this dissertation would not be possible.

I would like to sincerely thank the Park Family and the Roy H. Park Foundation for providing the generous gift that allowed me to be fully funded throughout my three years at UNC. I would also like to thank the Rubinstein Family for providing the necessary funds for my dissertation. The contributions from the Park and Rubinstein families allowed my ideas to come to fruition.

A special thanks goes to Eyes Ears Nose and Paws (EENP), which is a local nonprofit organization that partners service dogs with people. I have met some of my closest, lifelong friends through this organization. From my involvement with EENP, I met Elizabeth and her dog Rufus, who have both provided me remarkable support throughout my time in North Carolina. Having type 1 diabetes can be challenging and lonesome, but I never felt defeated nor alone when interacting with you two. You both are incredible, and I cannot thank you enough.

Finally, I would like to thank my dog and best friend Splenda, whom I received from EENP. Splenda has been by my side through this entire process, including: attending classes; traveling to conferences; recruiting participants in the clinic; lying next to me while I wrote this dissertation; and walking across the stage with me as we both graduated. Without her, I am not sure I could have finished this program nor dissertation, and she has been the greatest part of my life, without question.

TABLE OF CONTENTS

Appendices

Figures

Tables

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Type 1 diabetes (T1D) is a lifelong, self-managed autoimmune disorder that currently affects 132,000 children and adolescents in the United States under the age of 18 (Centers for Disease Control and Prevention, 2017). An additional 18,000 children under 18 are newly diagnosed each year (American Diabetes Association [ADA], 2019b), and the rate of new diagnosis is rising (Mayer-Davis et al., 2017). T1D is a unique disease in that it is almost solely self-managed, outside of three or four regularly scheduled doctor visits each year (primarily with endocrinologists). T1D is one of the few chronic illnesses in which patients are required to monitor and adjust their medication regimen continuously without much direct involvement from a healthcare team (Chiang et al., 2018; Silverstein et al., 2005).

The American Diabetes Association (ADA), along with clinical recommendations, state that successful T1D management routine includes blood glucose tests, proper insulin dosages – either through multiple dose injections (MDIs) or an insulin pump – based on blood glucose levels, consistent mealtimes, counting carbohydrates, and exercise (Chiang et al., 2018; Silverstein et al., 2005). A lack of proper management can lead to either high blood glucose levels which can result in long-term damage to blood vessels, nerves, and major organs, potentially resulting in nephropathy, retinopathy, neuropathy and cardiovascular disease (Chiang et al., 2018; Silverstein et al., 2005). Additionally, poor glycemic control leads to increased hospitalizations due to diabetic ketoacidosis (DKA) and further financial burdens for patients (ADA, 2019a). However, well-controlled T1D leads to reduced risk of these potential complications, and there is every right to believe that people with T1D can live a normal, healthy life (Campbell et al., 2014; Chiang et al., 2018; Silverstein et al., 2005).

For adolescents, though, proper diabetes management is often not achieved. It is estimated that only 14% of adolescents with T1D actually meet the ADA's glycemic clinical recommendations – based on hemoglobin A1c (HbA1c) and blood glucose monitoring frequency – for proper T1D management (Hood, Peterson, Rohan, & Drotar, 2009). HbA1c is a standardized measure of the amount of hemoglobin in an individual's blood that has interacted with glucose and reflects approximation average glucose levels over a period of approximately three months. HbA1c is an important indicator of long-term glycemic control, as it provides a reliable measure of chronic hyperglycemia (high blood glucose levels) and also highly correlates with the risk of long-term diabetes complications (Sherwani, Khan, Ekhzaimy, Masood, & Sakharkar, 2016). Clinical recommendations for target HbA1c levels for adolescents is 7.5 or below (Chiang et al., 2018), and most adolescents struggle to meet this goal. Past studies have also shown that adolescents between 12 and 17 years old tend to check their blood glucose less often than children (ages 0 to 11) and young adults (over 18) (Anderson, Ho, Brackett, & Finkelstein, 1997; Ziegler et al., 2011).

These data suggest that adolescents are an at-risk population for poor T1D management, but there are ways in which this can be improved. For example, while adolescents have been shown to be less frequent in blood glucose testing, their HbA1c levels improve the most when frequency of blood glucose testing increases, according to an 11-year longitudinal study involving almost 27,000 adolescents with T1D in Germany (Ziegler et al., 2011). While action-based items such as increased blood glucose testing have been shown to be effective, what may not be known fully, however, is the driving force behind motivating and encouraging adolescents with T1D to adhere to proper management and, perhaps more importantly, their psychosocial factors – such as self-efficacy, outcome expectations, diabetes acceptance, and stress and burnout perceptions – toward managing this lifelong disease.

One possible avenue to influence adolescents' T1D management is through the use of narrative messages. Narrative messages are individual stories that highlight lived experiences with a particular circumstance – such as disease management – and are crafted with a defined beginning, middle, and end (Shen, Sheer, & Li, 2015). Narratives have emerged as promising tools for motivating individuals as well as changing health behaviors (Hinyard & Kreuter, 2007). Narrative messages may be especially effective because of the ability to communicate personal experiences; share knowledge, attitudes, beliefs, and ideas about certain health issues; propose behavior change or discuss benefits of adopting a behavior; and assist individuals coping with a disease such as T1D. Adolescents, ages 12-17, are an ideal target for T1D management messages as they are developing or already have the capabilities to competently perform most self-management activities (Chiang et al., 2018; Silverstein et al., 2005). Furthermore, this age period provides an important developmental period in which adolescents can establish lifelong habits for T1D management, which currently has no cure (Dougherty, Lipman, Hyams, & Montgomery, 2014).

This dissertation developed narrative messages from true stories of people living with T1D and their journey through adolescence; utilized formative research to ensure message quality and effectiveness with the target audience of adolescents with T1D; and tested these narrative messages through an online experiment compared to standard of care materials that highlight the importance of self-management and offer steps on how to manage T1D, which are currently being used in clinical practice. The goal of this dissertation was to create effective narrative messages that resonate with adolescents with T1D, but also help them to improve their disease management. These messages could be used in clinical practice (i.e., through pediatric endocrinology departments), as another tool in which clinical practitioners – such as endocrinologists, certified diabetes educators (CDEs), nutritionists, and social workers – can use to improve the lives of their patients. Additionally, these messages could be implemented by advocacy organizations such as the Juvenile Diabetes Research Foundation (JDRF) to encourage adolescents to improve in their T1D management and have a different outlook about their disease, all while still maintaining a level of support for those affected by T1D.

In this dissertation, I first review the literature in several key areas related to the proposed work. These areas include: barriers to diabetes management for adolescents; past interventions that have been developed to improve T1D management for adolescents; narratives and their distinction from informational messages; and theories that help explain narrative effects. Then, I outline the process of message development and the importance of message testing to develop promising narratives about T1D management in Aim 1. Next, I test these narrative messages using a randomized online experiment involving a between-subjects design with adolescents with T1D who viewed sets of narrative messages or standard of care messages in Aim 2. Finally, the dissertation concludes with a discussion of the findings and future directions for research.

Literature Review

Barriers to Effective T1D Management

There are a variety of barriers that negatively affect adolescents' T1D management. These barriers include having the confidence (e.g. self-efficacy) to effectively manage their T1D (Iannotti et al., 2006); outcome expectations about the positive and negative outcomes that occur through T1D management (Iannotti et al., 2006); diabetes acceptance (National Collaborating Centre for Women's and Children's Health [NCC-WCH], 2015); psychological stressors such as stress and burnout, which can lead to depression, anxiety, and a lack of motivation (Corathers et al., 2013; Mulvaney et al., 2011a); a lack of hope about proper management (NCC-WCH, 2015; Silverstein et al., 2005); and difficulty or a lack of communicating with significant others such as doctors, parents, and peers about any potential problems (Chiang et al., 2018; Silverstein et al., 2005). These barriers have a direct link to diabetes adherence and glycemic control, so it is important to understand the underlying issues that may face adolescents with T1D (Greening, Stoppelbein, Konishi, Jordan, & Moll, 2006; Helgeson, Honcharuk, Becker, Escobar, & Siminerio, 2011; Mulvaney et al., 2011a).

This dissertation and the subsequent narrative messages aimed to address and remove these barriers, and ultimately improve the psychosocial factors for adolescents with T1D. While there are other barriers to management such as age, mental capacity, family dynamic, technology, socioeconomic status (SES), and dietary restrictions (Borus & Laffel, 2010), those factors were beyond the scope of this dissertation project because messages – and communication, in general – are generally unable to affect these barriers. This dissertation project primarily seeks to address psychosocial outcomes that narrative messages are capable of changing.

Self-efficacy. Self-efficacy is defined as a person's confidence to perform a targeted behavior in a given context (Bandura, 1977). This confidence can also potentially lead people to set higher goals and to remain more committed to completing the desired behavior. Furthermore, if setbacks occur, those with high self-efficacy recover more quickly and remain committed to their goals (Bandura, 1977). Regarding chronic illnesses such as T1D, adolescents are expected to take actions (e.g., administering insulin and consistently checking blood glucose) to reduce the negative effects of poor management (Cramm, Strating, Roebroeck, & Nieboer, 2013). Self-efficacy has shown to be a predictive factor for both improved HbA1c levels (Chih, Jan, Shu & Lue, 2010; Iannotti et al., 2006), as well as increased frequency of blood glucose testing (Helgeson et al., 2011; Iannotti et al., 2006).

However, taking the proper course of action is often not the case for adolescents with T1D (Chiang et al., 2018; Hood et al., 2009; Silverstein et al., 2005; Ziegler et al, 2011). Adolescents with T1D can feel overwhelmed and helpless in their ability to manage this chronic illness that essentially requires 24/7 management behaviors (Grossman, Brink, & Hauser, 1987; Iannotti et al., 2006; Lemanek, Kamps, & Chung, 2001). As children enter adolescence at 12 years old, parents may become less involved in their child's management, and the adolescents now assume a "burden of care," involving multiple blood glucose checks, insulin injections, close attention to diet and exercise, ongoing education, and frequent medication adjustments (Anderson, Svoren, & Laffel, 2007). Moreover, if this increase in autonomy and responsibility is not accompanied by a growth in maturity and self-efficacy to manage these tasks, adherence and glycemic control may deteriorate (Young, Lord, Patel, Gruhn, & Jaser, 2014). This would explain why HbA1c and the average number of glucose checks per day decreases for adolescents compared to the younger age ranges (Hood et al., 2009; Ziegler et al., 2011). From a clinical perspective, understanding how to increase self-efficacy could have direct implications for adherence, which could improve the lives of adolescents with T1D (Ott, Greening, Palardy, Holderby, & DeBell, 2000).

Outcome expectations. Outcome expectancies are beliefs or perceptions of the consequences – either positive or negative – of a behavior (Bandura, 1977, 1986). T1D self-management can have varied positive outcomes: personal (e.g., improved performance in school and sports), social (e.g., less conflict with parents or doctors), and physical (e.g., reduced symptoms and health problems) (Iannotti et al., 2006). Outcome expectations derive in part from past experiences, and for adolescents with T1D, these experiences with T1D management may be negative given the historically poor management among this population (Hood et al., 2009). While HbA1c is largely predicated on the self-management tasks that people with T1D perform (e.g. increased blood glucose monitoring, proper insulin dosage based on blood glucose readings, and a healthy diet and exercise), there are other factors that come into effect, such as stress and hormones (Neylon, O'Connell, Skinner, & Cameron, 2013). Particularly for adolescents, who are going through puberty and dealing with social stressors, positive actions they take may not have an immediate impact on their HbA1c, which can negatively affect their outcome expectations toward their T1D management (Borus & Laffel, 2010). Furthermore, greater perceptions of T1D consequences have the potential to produce emotional distress, which, in turn, could directly impact on blood glucose regulation, leading to worse glycemic control (Griva, Myers, & Newman, 2000). Thus, the adolescents with T1D may already believe that the only outcomes for their management will be negative.

Another negative outcome expectation that many adolescents hold is refusal to actively manage their T1D outside the comforts of their home, with fear that they will be perceived as different from peers (Borus & Laffel, 2010). Adolescents often believe that engaging in appropriate self-management tasks, such as blood glucose testing in public settings like school, requires full self-revelation and showcasing of vulnerability to peers, which leads to avoidance of testing and poorer adherence (Grey, Boland, Davidson, Li, & Tamborlane, 2000; Thomas, Peterson, & Goldstein, 1997). Regarding peers, adolescents with T1D often feel that their friends would have negative reactions about their disease (Hains, Berlin, Davies, Parton, & Alemzadeh, 2006). Despite this, studies have shown that friends often provide encouragement when someone they know is diagnosed or living with T1D (La Greca, Bearman, & Moore, 2002). Thus, the negative outcome expectations that adolescents with T1D can hold about social situations may not accurately represent reality.

Diabetes acceptance. Acceptance of a chronic disease is challenging for adolescents (Berntsson, Berg, Brydolf, & Hellström, 2007), and this is no different for adolescents with T1D. First, diagnosis of a chronic disease such as T1D can be accompanied by a period of denial (NCC-WCH, 2015). Furthermore, being diagnosed with T1D leads to drastic lifestyle changes, including more close monitoring of blood glucose levels, administering insulin, and being aware of warning signs for problematic high and low blood glucose levels (Chiang et al., 2018; Silverstein et al., 2005). Adolescents with T1D are tasked with continuously monitoring a chronic disease, while also trying to maintain a normal life and not be dissimilar from their peers (Borus & Laffel, 2010). To this point, Greydanus and Hofmann (1979) claimed there is a need to assist adolescents with T1D in maintaining a sense of competence and self-esteem, and to provide reassurance that they have not lost control of their life. Interestingly, in a survey with 425 adolescents with T1D and parents of children (ages 8 and older) designed to identify self-management barriers, Cox et al. (2014) found that adolescents did not claim to be in denial of their T1D nor acknowledge it serves as a barrier to their management; however, parents of children with T1D did identify acceptance as a barrier. Thus, there might be differences for how adolescents and parents perceive their diabetes acceptance levels.

Stress, burnout, and hope. For adolescents, the stress of managing T1D can have negative psychological effects. Almost 10% of the general population of adolescents have shown some signs of depression (Merikangas et al., 2010), but the rate is significantly higher for adolescents with T1D (Grey, Whittemore, & Tamborlane, 2002; Hood et al., 2006; McGrady, Laffel, Drotar, Repaske, & Hood, 2009). When present, depression in adolescents with T1D is associated with less frequent blood glucose monitoring, elevated HbA1c levels, and increased rates of T1D-related hospitalizations such as DKA (Corathers et al., 2013).

This added stress can lead to "diabetes burnout" where adolescents reduce or even quit management altogether, which leads to poor adherence and glycemic control. Furthermore, the risk of diabetes burnout is positively correlated with length of diagnosis, meaning the longer an adolescent has T1D, the more likely he or she is to experience burnout (Borus & Laffel, 2010; JDRF, 2013; Silverstein et al., 2005). Additionally, Mulvaney et al. (2011a) surveyed 123 adolescents with T1D to understand the relationship between psychosocial barriers and adherence. Mulvaney and colleagues found that stress and burnout were the most prevalent barriers for adolescents with T1D. This resulted in feelings of frustration, anxiety, and a lack of motivation about their diabetes management. Managing T1D is a daunting task for even the most motivated adolescents; therefore, a lack of motivation can be directly correlated to poor T1D management (Borus & Laffel, 2010; Mulvaney et al., 2011a).

One factor that may mitigate stress and burnout is hope, and maintaining hope is a key component to self-management for chronic illnesses (Schulman-Green et al. 2012). Lazarus

(1991) defines hope as “wishing and yearning for relief from a negative situation, or for the realization of a positive outcome when the odds do not greatly favor it” (p. 282). Additionally, hope contains a motivational component that can promote behavioral intention and action-readiness (Nabi, 2010). For adolescents with T1D, hope has shown to be a predictor of adherence and glycemic control (Lloyd, Cantell, Pacaud, Crawford, & Dewey, 2009). Unfortunately, adolescents are susceptible to lower levels of hope and optimism about their disease management due to the aforementioned rigorous treatment standards (Chiang et al., 2018; Silverstein et al., 2005).

Communication. Communication in medical care is highly correlated with improved patient adherence (Zolnierek & Dimatteo, 2009). For adolescents with T1D, however, communication about their disease management is often lacking (Silverstein et al., 2005; Verchota & Sawin, 2016). This decrease in communication occurs with both their healthcare providers, as well as friends and family. In communicating with healthcare providers, in particular, adolescents may not vocalize the struggles they are facing when it comes to their T1D (Gandhi, Vu, Eshtehardi, Wasserman, & Hilliard, 2015). Often, healthcare providers can only look to management activities such as number of blood glucose checks, which is determined through glucometer or CGM (if applicable) downloads, or insulin dosages delivered through an insulin pump (if a patient uses one) to monitor adherence. Healthcare providers need more communication with adolescents regarding their management problems in order to potentially change avenues for treatment (Gandhi et al., 2015). While burnout and a lack of motivation may be factors, other reasons that adolescents may not speak candidly with their healthcare providers is a lack of trust, fear of being reprimanded for poor adherence, or fear that they will be asked to do more management activities (Monaghan, Hilliard, Sweenie, & Riekert, 2013). For example, Borus and Laffel (2010) outlined that the burden of care potentially intensifies for adolescents with T1D as their adherence worsens. Simply put, adherence is made more challenging the worse glycemic control becomes because adolescents are placed on stricter regimens by their healthcare providers. This process may be counter-productive to management. Additionally, as outlined before, social situations may cause a decrease in communication. Despite these concerns, Verchota et al. (2016) found that communication with doctors, family, and friends was correlated with increased quality of life perceptions and adherence; thus, increasing communication about the disease is an important step for adolescents with T1D.

Overall, T1D is a unique disease in which there are multiple barriers that adolescents with T1D face, making adherence and management more difficult. Additionally, these barriers often overlap and can exacerbate one another. This dissertation aims to address these barriers and improve outcomes through the use of narrative communication.

Interventions to Improve T1D Management for Adolescents

While these barriers to T1D for adolescents are well documented, there have been few efforts to formally address these problems from a communication perspective through the use of narrative messages. Past interventions involving adolescents with T1D have occurred through various channels, including the use of mentors, text-messaging and cell phone-based interventions, telemedicine, and Internet-based programs. While some studies utilize messaging, there has been more emphasis on promoting what adolescents should be doing to manage their T1D, rather than emphasizing why they should be managing their disease, as well as providing an understanding of their challenges and offering positive outcomes. For example, past efforts have focused on messages that are short in length, with most being simple cues to remind adolescents to take appropriate action to manage their T1D. Such messages do not provide in-depth motivational stories about someone’s personal experience living with T1D. I briefly review some of these interventions next.

Daley (1992) created a 10-month intervention to provide adolescents with T1D a positive role model. During this intervention, adolescents in the treatment condition were each partnered with an adult (ages 25-43) who also had T1D, while the control group did not receive a role model. Adolescents and their adult role models had bimonthly meetings where they would interact and do activities such as going to concerts or playing sports, with T1D adherence being integrated through the use of the role model, instead of these sessions being treated as a doctor’s appointment where the role model would lecture the adolescent on the importance of T1D management. At the end of the intervention, the treatment group had more positive attitudes toward having T1D and adolescents showed some improvement in their glycemic control, compared to the control group, who received no role model or education about T1D management. Perhaps most importantly, adolescents in the treatment group stated that they would like to emulate their sponsors, and “many of them had not been exposed to an adult who shared their experiences and who had become successful in spite of the obstacles” (p. 178).

Barnetz and Feigin (2012) also conducted an intervention that partnered adolescents with T1D to an adult counterpart who had the disease. The aim of the program was to create motivation in adolescents for dealing with the demands of T1D; to make them more aware of the importance of adherence; to help them accept their T1D; and to provide tools to change their behavior. Adolescents and their mentors met once a week for two hours over the course of a year. One key finding from the study showed that adults with T1D can serve as “admired role models.” Barnetz and Feigin classified this as adolescents having “a feeling of admiration for their mentors, enthusiasm about spending time together, about their lifestyle, and their ability to make diabetes part of their life” (p. 472). The admired role models helped adolescents adopt positive behaviors and attitudes toward T1D, with one participant saying “If he does it and it seems so good, then maybe I can too.”

Franklin, Waller, Pagliari, and Greene (2006) developed and tested one of the first text-messaging interventions for children and adolescents with T1D, called *Sweet Talk*. Throughout the intervention, those in the treatment condition were sent a series of text messages that were tailored – based on age, sex, and diabetes care regimen – to the participant. These included daily messages that provided tips, information about T1D management, and reminders to reinforce goals set in the clinic by healthcare providers. The messages included statements such as “Don’t forget to inject!” or “Do you have any questions for the doctors or dietician?” They found that scheduled, tailored text messaging offered an innovative means of supporting adolescents with diabetes through increasing self-efficacy, promoting adherence, and improving glycemic control. Of the participants who received the text messages, 81% believed it helped their management. Furthermore, and perhaps just as important as clinical outcomes, 90% of participants wanted to keep receiving messages after the intervention ended. Additionally, 97% of patients liked the frequency of messages received (one or two daily). While these messages were only brief reminders to manage their disease or promote communication with their healthcare team, this shows that T1D messages are well received and preferred by adolescents.

In another mobile phone intervention study, Mulvaney, Anders, Smith, Pittel, and Johnson (2012) used text messages to encourage and remind youth about diabetes-related management tasks. Interestingly, this study was one of the only ones to utilize tailored text messages based on participants’ individually reported barriers to diabetes management. Through an automated system (*SuperEgo*), participants received motivational text messages to improve their T1D management. Messages included statements such as, “Hey [recipient’s name], it’s OK to tell people that you feel frustrated with diabetes,” and “Make taking care of diabetes easier, and put supplies where you will remember them. If you tell yourself that you will take care of diabetes later, are you being realistic?” Although the treatment group did not statistically improve HbA1c levels compared to the control group, the control group participants’ HbA1c actually worsened over time while the treatment group participants’ HbA1c remained consistent. Additionally, participants in the treatment group reported better feelings about their T1D management, and they found the messages to be helpful in remembering to complete tasks and in motivating them to stay on top of their diabetes.

Rami, Popow, Horn, Waldhoer, and Schober (2006) incorporated a telemedicine intervention with adolescents (ages 10-19) with T1D. During a three-month telemedicine phase, adolescents sent daily T1D management data (such as blood glucose levels, insulin dosage, and carbohydrate intake) to a team of healthcare practitioners. Upon receiving the data, healthcare providers sent tailored pieces of management advice via text message. After this portion of the intervention was complete, adolescents were then asked to record all information via paper. The telemedicine phase of the intervention involving real-time feedback from healthcare providers proved successful in improving HbA1c. Conversely, during the paper diary phase where adolescents received no additional contact with their healthcare providers, HbA1c levels actually worsened. This study showcases the importance of receiving additional information from healthcare providers when dealing with adolescents with T1D.

In an intervention utilizing an Internet-based problem-solving program involving stories from characters with T1D, Mulvaney et al. (2011b) worked with adolescents to fully understand barriers and develop ways to reduce them. The intervention included six barriers that were previously identified as barriers to T1D adherence (Mulvaney et al., 2011a). These included social issues such as social isolation; psychological reasons such as stress, burnout, and apathy; and time pressures dealing with trying to keep up with T1D with a busy schedule. The intervention (*YourWay*) encouraged adolescents to read stories pertaining to T1D barriers that may be salient to them, followed by steps to remedy these situations. *YourWay* was successful in teaching adolescents how to overcome T1D-related barriers through the use of presenting these barriers in a story format. Overall, adolescents indicated that the characters in the stories were authentic, and almost all participants (97%) thought the stories accurately depicted barriers adolescents with T1D face. Additionally, 77% of participants believed these stories, and steps to overcome challenges provided adequate support to solve their own self-management problems.

As is evident from this review of interventions for adolescents with T1D, adolescents respond strongly to role models who have T1D as well as messaging efforts about the disease. As adolescents interact with others who have T1D and receive messages, they are generally motivated to improve their management and may feel better about having the disease. While Mulvaney et al. (2011b) incorporate stories that outlined challenges, there seems to be little interventions or large-scale messaging efforts that incorporate a narrative message about someone's journey living with T1D. This may be because most messaging efforts focus on action-based tasks such as checking blood glucose and reminding adolescents to correctly count carbohydrates, whereas narrative messages can target more of a motivational and uplifting outlook toward disease management. This dissertation aims to bridge that gap.

Narrative Messages

A narrative is a type of message that can be facilitated through a personal story or testimonial, the use of an exemplar, or entertainment programs (e.g., entertainment education).

Narratives have a long history in communication, but Green and Brock (2000), Hinyard and Kreuter (2007), and Kreuter et al. (2007, 2010) were the main pioneers in conceptualizing the ways in which narratives could be applied in communication and health communication. The general consensus is that narratives are stories that should have a clear beginning, middle, and end, which is often laid out in the plot. Furthermore, narratives should have relatable characters, raise unanswered questions, provide a conflict, and ultimately resolve the conflict, with a main emphasis on behavior change. Narratives can be delivered through a variety of channels, including print, television, digital, radio, and interpersonal (such as one-on-one talks or group sessions).

For health communication, in particular, narratives can be influential in motivating individuals and getting them to adopt a health behavior (Hinyard & Kreuter, 2007). Narratives can communicate personal experiences and perspectives toward disease management and discuss benefits of adopting a behavior. Kreuter et al. (2010) argued that narratives can be effective in capturing an audience's attention, enhancing their understanding, and aiding in recall of a message. Additionally, Green (2006) emphasized that narratives can be useful in motivating people to act. This is primarily accomplished because characters in the narratives may serve as a positive example and successfully show how to overcome conflict. Campbell, Dunt, Fitzgerald, and Gordon (2013) suggested that narratives should contain messages in which knowledge acquired by a patient, primarily through daily occurrences with the disease, is conveyed to those who seek information about the disease.

Narratives are particularly effective when the audience can identify with the characters. Cho, Shen, and Wilson (2014) classified identification as "the bond, connection, or relatedness that the audience perceives with the character of a narrative" (p. 833). Identification can also mediate the relationship between narrative messages and a person's attitudes toward a particular issue (de Graaf, Hoeken, Sanders, & Beentjes, 2012; Igartua & Barrios, 2012). For health-related narrative messages, identification with the character may lead to positive attitudes toward the health behavior (Igartua & Casanova, 2016).

Moreover, identification can lead to increased engagement with the narrative message. A main driving force behind engagement is the idea of perceived similarity, which is the receiver's judgement about how similar the narrative character is to them. Greater levels of perceived similarity are associated with higher levels of attention and persuasiveness of the message (Kreuter et al., 2007). Additionally, Green, Garst, and Brock (2004) explain that a narrative can feel like a real experience, and direct experience should lead to stronger attitudes. In the case of messages for adolescents with T1D, narratives about a person who is only successful in managing his or her T1D may be ineffective, since many adolescents do not have this direct experience of having no issues. Conversely, narrative messages should highlight barriers to T1D management and overcoming those obstacles. Thus, for an adolescent who is currently struggling to manage his or her T1D, a narrative message about someone's journey through the struggles and subsequent behavior change could cause them to see things in a different way. That is, they may identify with the character, see similar experiences, and adopt behavior changes that the narrative messages outline, such as improved self-efficacy about managing T1D in public or having more open communication of the disease with others.

Furthermore, narratives can lead the audience to become attached to the characters, which may bolster message effects (Green, 2004; Green & Brock, 2002). Essentially, narratives can be effective if the message topic has high salience for the audience. For example, in a narrative about a person with T1D who is struggling with high blood sugars and elevated HBA1c levels, the adolescent who receives the narrative message will likely be able to relate to the struggles of the character. The adolescent can then see how the character in the narrative solves this problem and can then adopt similar behaviors. While adolescents with T1D may be aware of what they should do to manage their disease, such as checking blood glucose levels more often, they may be so ingrained in their own personal struggle that they cannot see the long-term payoff for proper management. When trying to approach how adolescents with T1D can improve their relationship with peers, Grey et al. (2000) suggested that, "Teens can be trained to think of new, less differentiating behaviors that allow them to adhere to an intensive regimen without compromising peer relationships" (p. 109). Narrative messages can offer an avenue to accomplish this by offering novel solutions to barriers that adolescents with T1D face, such as using testing blood glucose in public as a way to inform others about the disease, rather than feeling ashamed of having it.

Narrative messages lend credence to the notion of personal involvement, which has been shown to be a primary factor in persuasion. Through the lens of the Elaboration Likelihood Model (Petty & Cacioppo, 1986), those who process the message centrally – such as being influenced by argument quality and salience – compared to peripherally – where message cues or quantity of messages are key – may be more likely to adopt the health behaviors in the message. In this dissertation, the narratives touch on diabetes-specific challenges, such as diabetes burnout, that adolescents face and present ways to overcome this barrier. Because adolescents have personal involvement with challenges associated with T1D management, there may be a greater likelihood that they will adopt the behaviors presented in the narratives.

In relation to perceived similarity and personal involvement, narratives can also serve as a proxy for personal experience (El-Khoury & Shafer, 2016). This suggests that people without relevant personal experience who receive a narrative message may be more likely to accept the message and adapt their behaviors because they have relatively few real-world competing experiences. While every adolescent with T1D will have direct experience with managing T1D, what they may not have is direct experience with the required behaviors to properly manage their disease, given that only 14% meet clinical recommendations (Hood et al., 2009). El-Khoury and Shafer (2016) suggest that people with relevant personal experience different to what the message entails may resist the message or adopt subsequent behaviors because their own experience is more salient. The narrative messages in this dissertation tackle this issue by first outlining and acknowledging barriers that adolescents face, before describing the steps to overcome these challenges. The narrative messages can offer a sense of understanding, which may lead to more personal involvement and acceptance of the message.

To this point, another way in which narratives are effective is that they can reduce or even eliminate counter-arguing. Counter-arguing is often considered a sign of message reactance, which can reduce message effectiveness (Dillard & Shen, 2005). However, past research suggests that individuals counter-argue less with narrative messages (Moyer-Guse & Nabi, 2010). Narrative messages offer detailed descriptions of events through a character with lived experiences, and thus it becomes difficult for an individual to dismiss these experiences (Green, 2006). Furthermore, Green (2002) claimed that individuals who are fully transported (i.e., immersed) in a story are less susceptible to counter-arguing against the message, which can then increase the believability of the message.

Slater and Rouner (2002) also argued that absorption and connection with the character in the narrative are key elements for reducing counter-arguing. Thus, those with T1D who see narrative messages that outline challenges to disease management and are transported into the message may be less likely to reject the message's claims about improving management (e.g., this is what you *have* to do) and believe they can also take the appropriate action to better manage their T1D.

Narratives vs. Informational Messages

While narratives typically involve in-depth stories about a person dealing with a conflict and its subsequent resolution, informational messages primarily include expository communication and a presentation of facts (e.g., statistics) or didactic information. Rather than inviting the audience into the story's actions and immersing them in the character's experiences like narratives often do, informational messages tend to construct more explicit arguments for readers to judge themselves.

There have been several studies that have compared narratives and informational, fact-based messages, and there is substantial evidence that narratives may be a more effective approach in several areas of health communication. For example, Kreuter et al. (2010) looked at the difference between narrative and informational videos on the use of mammography, and found that the narratives were better liked, had better recall, significantly reduced counter-arguing, and increased interpersonal discussion about the importance of getting a mammogram. Additionally, Niederdeppe, Shapiro, and Porticella (2011) found that narratives reduced counter-arguing regarding obesity information compared to summaries of evidence, and that narratives were more effective in promoting behaviors to avoid fatty foods.

When looking at communication efforts for cervical cancer, Murphy, Frank, Chatterjee, and Baezconde-Garbanati (2013) tested whether narratives would produce greater impact on health-related knowledge, attitudes, and behavioral intention than presenting identical information in a more traditional, informational format. They found that the narrative messages were more effective in increasing cervical cancer-related knowledge and attitudes. This was primarily caused by participants being transported into the story, identifying with the characters, and experiencing strong emotions. Murphy and colleagues (2013) further argued that a narrative format for a message would be effective in shifting knowledge, attitude, and behavioral intention in order to reduce health disparities. Moran, Murphy, Frank, and Baezconde-Garbanati (2013) also found that film narratives detailing a specific character were more effective at producing positive changes in social norms and behavioral intention for Pap testing compared to a facts-based, more traditional informational film.

While individual studies have supported narratives, meta-analyses have exhibited mixed results. In a meta-analysis with 15 studies, Allen and Preiss (1997) reported that, overall, statistical information was more persuasive than narratives. Zebregs, van den Putte, Neijens, and de Graaf (2015) also performed a narrative vs. statistical information-based message meta-analysis with 15 studies, but instead focused solely on health campaigns. They found that statistical evidence has stronger influence than narratives on beliefs and attitude, whereas narratives have a stronger influence on intention. Statistical evidence, beliefs, and attitude were primarily related to cognitive responses, and narrative evidence and intention related more to affective responses.

Braddock and Dillard (2016) performed a meta-analysis of 74 studies to examine the effects of narratives on attitudes, beliefs, and behaviors, and the meta-analysis found that narratives have a positive effect on these outcomes. This meta-analysis looked at narratives vs. control (either no message or completely different topics), and did not try to specify the differences of types of message (e.g., narrative vs. statistical).

Shen and colleagues (2015) performed a further meta-analysis on narratives in health communication with 25 studies, but focused on delivery method (i.e., print, audio, video) in order to see if narratives affected attitude, intentions, and behaviors. Narratives delivered via audio and video were found to be more effective than print narratives. This analysis further found that print narratives did not have any significant effects at all. However, their sample of print narratives ranged widely in length, with some being as short as 72 words and the longest being over 1,200. When controlling for message length, the meta-analysis found that longer narratives (i.e., having more than 400 words) were, in fact, effective for health behavior change. Additionally, Shen and colleagues (2015) found that specific health behaviors were better suited for narrative effects. These health behaviors included detection and prevention, whereas ineffective narratives were aimed at cessation attempts.

In regards to T1D, the use of narratives represents an opportunity for the improvement of T1D management in adolescents, and to date, it has been underutilized. For example, the Shen et al. (2015) meta-analysis detailed how narratives affect specific health behaviors such as detection, prevention, and cessation; however, T1D may not fit into any of these three categories, as it is more of a management and treatment-focused health behavior. What is unknown is how narrative messages can impact health behaviors like T1D management. Additionally, none of the aforementioned meta-analyses included studies regarding T1D. There is a clear gap in the literature regarding use of narratives for adolescents' T1D management, which is an important area that this dissertation will fill.

Theories Applied to Narratives

Theory plays a pivotal role in creating health messages (Noar, 2006), as theories help explain and determine why things happen. Theory lays the foundational groundwork for the messages, and the constructs that drive behavior change are used as the basis for message design.

Next I discuss theories that have high relevance to narrative communication.

Transportation theory. Transportation theory is one of the theories that is most closely associated with narratives. Green and Brock (2000) conceptualized transportation as the process by which individuals are absorbed into a story or transported into a narrative world, which may enhance effects of the story on their beliefs, attitudes, and intentions. They conceptualized transportation as involving three steps. First, readers are so immersed into the narrative that they lose sense of their own world and began to accept the world in which the narrative takes place. Second, readers experience strong emotions and motivations based on the events in the narrative (Mazzocco, Green, Sasota, & Jones, 2010). Finally, readers return from their transportation with an altered view of their world and an acceptance of a new behavior. Transportation is effective for persuasion because it not only reduces counter-arguing, but it also allows the audience to fully connect with the character in the story. This is especially effective if the character and the audience are similar (e.g., both have T1D). Green (2004) argues that transportation is the key mechanism behind narratives, as its true nature is to provide compelling, immersive stories that will impact an audience. If an audience is not transported into the story, then the message may not have the desired effects for health behavior.

Theory of reasoned action. The theory of reasoned action (TRA) posits that behavioral intention is predicated by the belief that others approve of a behavior (normative appeals) and a person’s own attitude toward the health behavior (Ajzen & Fishbein, 1980, 2005). Through the use of a normative appeal, narratives told by individuals perceived as similar to the audience or with whom the audience identifies may affect normative beliefs. Additionally, the use of a personal experience narrative can showcase positive attitudes about the health behavior. All of these may increase behavioral intentions to perform the desired health behavior.

Social cognitive theory. Social cognitive theory (SCT) focuses on the effects that modeling and vicarious learning have on self-efficacy and the acquisition of behaviors (Bandura, 1986). Narrative messages are particularly effective in providing a model for an audience, through the use of a personal story about how the character handled – and subsequently overcame – a conflict. According to SCT, seeing similar others succeed at a task can help build confidence (i.e., self-efficacy) to perform a behavior. Additionally, perceived similarity (which is related to SCT's modeling) is an important part of narratives, such that those receiving the message can better relate to the character (Kreuter et al., 2007). For example, by learning how a character in a narrative overcame a particular challenge (e.g., poor T1D management), an individual can increase self-efficacy to perform the behavior themselves (e.g., confidence to check his or her blood glucose in public), learn a new skill (e.g., how to talk to friends about their T1D management), and improve outcome expectations for the behavior (e.g., "if I check my blood sugar more often, I will have less high blood sugar which will make me feel better").

Before engaging in a specific behavior, SCT posits that people anticipate the consequences of their actions, and these anticipated consequences can influence whether they perform the behavior (Bandura, 1986). These outcome expectations derive largely from past experiences, and for adolescents with T1D, past experiences with T1D management may be negative due to poor control and a variety of barriers (Borus & Laffel, 2010; Hood et al., 2009; Mulvaney et al., 2011a). Thus, messages need to acknowledge challenges with T1D management but also provide positive long-term outcomes for consistently staying on top of the disease. Creating positive outcome expectations for T1D management is a key component for adolescents with the disease, as well as potentially reducing negative outcome expectations (Iannotti et al., 2006).

Moreover, self-efficacy – or the confidence one has in his or her ability to perform the health behavior – has been linked to increased blood glucose monitoring, which leads to improved glycemic control (Helgeson et al., 2011; Ott et al., 2000). Iannotti et al. (2006) found that self-efficacy and the interaction of self-efficacy with expectations of positive outcomes were significantly associated with T1D self-management adherence for adolescents. In a 5-year longitudinal study examining the relationship between blood glucose monitoring and its subsequent glycemic control among adolescents with T1D and their parents, Helgeson et al. (2011) found that children with higher reports of self-efficacy exhibited more frequent monitoring, leading to better glycemic control. Improved self-efficacy may be achieved in many different ways. These include mastery experiences from past successful diabetes management that have resulted in observed desirable health outcomes (i.e. lower HbA1c or more frequent blood glucose testing); social persuasion from important others (i.e. doctors, family members, other families affected by T1D); and social modeling showing how other people with diabetes have successfully managed their disease.

Because SCT establishes many avenues in which narrative messages may be successful for adolescents with T1D, this theory provided the foundation for message development in the present dissertation. The messages in the current dissertation target each component of the theory. For example, using a character who has T1D (modeling) to explain how checking blood glucose more frequently (desired behavior) led to improved confidence in management (self-efficacy) and an improved attitude about self-management leading to positive outcomes (outcome expectations), while also reducing negative outcomes.

Aim 1: Narrative Message Development and Pretesting for Adolescents with Type 1 Diabetes

Formative research is a crucial step to ensure success in the development of messages, interventions, or campaigns. Formative research ensures that communication efforts appeal to the target audience and increases the chances that these efforts will have a meaningful impact. In health communication, formative research contributes to more successful campaigns (Atkin & Freimuth, 2013; Noar, 2006). Formative research involves two stages: preproduction and production (Palmer, 1981). The preproduction stage is where researchers collect data from their target audience based on what is important to them (e.g., channel, message design and content). In the preproduction stage, researchers need to learn as much as possible about the target audience before creating message goals and developing strategies. Next, the production stage – more commonly known as pretesting – is where samples or drafts of the messages are evaluated prior to final production.

Atkin and Freimuth (2013) describe how formative research can improve message effectiveness by helping with the development of strategic and impactful messages. To this point, formative research can help researchers identify what types of messages will attract their target audience's attention; know if their target audience understands the goals of the message; and evaluate whether the messages may have the intended effect to change the health behavior (e.g., improved T1D management). Essentially, formative research allows for researchers to effectively test their messages and understand what the target audience likes or does not like. From this feedback, messages can be effectively revised before launch of the actual project. This not only allows for more effective messages, but it can also save time and money, and may lead to meaningful outcomes based on the message.

Formative research involves several components to ensure success, as outlined by McCormack Brown, Lindenberger, and Bryant (2008), starting with a review of the literature for the topic. Next, it is important to speak with experts to gain feedback about message content. Then, and most importantly, the target audience needs to be consulted. This can occur through focus groups, in-depth interviews, intercept interviews, or surveys. Lastly, revisions to the messages are made based on this feedback. Revisions should be made based on recurring themes based on the formative research.

Additionally, an important tool in formative research is perceived message effectiveness (PME). Applying PME in formative research and message development is becoming increasingly common in health communication, as it allows for target audience members to rate the potential effectiveness of messages and thereby provide message selection guidance to message designers (Bigsby, Cappella, & Seitz, 2013; Dillard, Weber, & Vail, 2007; Noar, Bell, Kelley, Barker, & Yzer, 2018; Yzer, LoRusso, & Nagler, 2015). PME may be able to predict the likely effects of health messages, providing data relevant to the removal of ineffective messages prior to resources being devoted to such messages (Noar, Barker, Bell, & Yzer, 2018; Yzer et al., 2015). Finally, in some studies, PME is also used as an early indicator of message receptivity after messages are fully developed or deployed (Duke et al. 2015).

Best practices for formative research were followed in this dissertation during the message development process. First, the literature was consulted to understand barriers to management that adolescents with T1D face. Next, experts were consulted about the message content. These experts included myself, who was diagnosed with T1D almost two decades ago, as well an endocrinologist, certified diabetes educator (CDE), nutritionist, and social worker at the pediatric endocrinology clinic at the University of North Carolina Children's Hospital. After initial messages were developed, pretesting with the target audience of adolescents with T1D took place. After this process was completed, messages were adapted and tested in an online experiment outlined in Aim 2.

In general, formative research allows for researchers to effectively test their messages and understand what the target audience thinks is effective or ineffective, which can also be evaluated for impact in a later study. From this feedback, messages can be revised extensively before ultimately being finalized. This dissertation develops and refines narrative messages using a standard, formative development process outlined by McCormack Brown et al. (2008).

Methods

The purpose of aim 1 was to a) develop effective narrative messages about T1D management; and b) understand how the target audience of adolescents with T1D responded to the messages before final production. This process involved two stages of formative research: preproduction and message development involving college students with T1D; and production and message pretesting involving adolescents with T1D. Figure 1 shows the steps taken for message development, including the preproduction and production stages.

Phase I: Preproduction & Message Development

All messages in this study were developed following a conceptual model (see Figure 2) for how the narratives may influence diabetes acceptance, self-efficacy, outcome expectations, and stress and burnout perceptions, which could then influence behavioral intentions. Based on these intentions, adolescents with T1D should see improved diabetes management, through increased blood glucose testing, lower HbA1c, and more frequent communication with important others (e.g., family, friends, and healthcare providers) about their disease.

In order to create narrative messages related to adolescents' T1D management, college students with the T1D were recruited. Past research has shown that adolescents respond positively to health messages from credible sources (Cates et al., 2015) and from slightly older peers more than same-age peers (Franzen. Morrel-Samuels, Reischl, & Zimmerman, 2009; Lourenco et al., 2015), whom they make look up to. Additionally, past interventions using adults with T1D as role models have proven successful (Daley, 1992; Barnetz & Feigin, 2012). This was the reasoning behind choosing college students with T1D to feature in narrative messages targeted to adolescents. Additionally, perceived similarity is an important part of narratives, such that those receiving the message can relate to the character (Kreuter et al., 2007). In the current narratives, while the characters were older than the target audience of 12-17 year olds, the narratives included a significant focus on these college students' journeys through adolescence, including T1D management challenges. Thus, the message sources were credible because they are living with the same disease and going through what the adolescents are experiencing. Bandura (2004) posited that having a recognizable character can provide examples for the target audience on how to effectively handle similar problems, which in this case revolved around T1D management failures and successes.

Participant Recruitment

College students who have T1D (*n* = 6) were recruited to provide their stories and personal testimonials about their experience growing up and living with the disease to serve as the basis for the narratives created in this study. Participants were recruited from the pediatric endocrinology clinic at the University of North Carolina Children's Hospital and through word-of-mouth communication in North Carolina. From the endocrinology clinic, a practicing endocrinologist and social worker identified patients who were currently enrolled in college, have displayed successful management (i.e. acceptable HbA1c levels and consistent blood glucose testing frequency), and were confident in their ability to manage T1D. Participants who provided stories for the narrative messages were both male (*n* = 3) and female (*n* = 3), and all were White. Five were undergraduates and one was a graduate student. Ages ranged from 19 to 27 (*M* = 21.67, *SD* = 2.81), and age at first diagnosis with T1D ranged from 4 to 16 (*M* = 10.5, *SD* = 4.64).

Once individuals were identified, participants were encouraged to contact me to set up a time for an interview, which took place in person. An interview guide (Appendix A) was developed focusing on questions about their thoughts at the time of diagnosis; immediate challenges they faced; involvement of parents in their management; new challenges that emerged as they got older; social situations regarding T1D; confidence in their ability to manage the disease in a variety of settings; how the shift in autonomy during adolescence affected their management; and what advice they would give to younger people diagnosed with T1D. Participants signed a consent form, and interviews lasted 20 minutes and were audio-recorded and transcribed. Each participant was given a $20 gift card as an incentive for participation.

Narratives were written based on five of the six participants, and each narrative was later evaluated by the target audience of adolescents ages 12-17 with T1D. One participant's story of their T1D management was excluded because he was not diagnosed until age 16 and did not have experiences consistent with what younger (e.g. 12-14 year olds) and more typical adolescents with T1D may face, such as gaining autonomy from parents (Chiang et al., 2018; Silverstein et al., 2005). All procedures used in this study were approved by the Institutional Review Board at the University of North Carolina at Chapel Hill.

Steps in Creating the Narratives

When developing messages, it is important to have a beginning, middle, and end (Thompson & Kreuter, 2014). In the context of health narratives, this primarily involves the following: a description of the current situation faced by the character in the message; a conflict that hinders the desired health behavior; a connecting strategy that allows the character to overcome the challenge; and, finally, a resolution to how this behavior change ultimately positively affected the situation (Boeijinga, Hoeken, & Sanders, 2017; Thompson & Kreuter, 2014). Like most messaging efforts, the success of a narrative is also dependent on quality. When designing a quality narrative message, Green (2006) stated that narratives should be well written, have engaging and relatable characters, spark mental imagery of the events taking place in the narrative, and ultimately be able to transport (e.g. immerse) the audience into the narrative. Furthermore, Kreuter et al. (2007) identified five attributes of quality narratives, which include: sequence (e.g., plot development); character (e.g., relatable characteristics or character development over the narrative); structure (e.g., conflict or tension); bounded in space and time (e.g., realism, vivid imagery and details); and message production (e.g., production values such as lighting, sound, or visuals). These attributes were focused on in the development of narratives for this study.

For sequence, narratives for adolescents with T1D should have a clear plot. This first starts with setting the scene. In the five initial messages created for this dissertation, each starts with the diagnosis of T1D (beginning). Each talks about a new reality that the kids have to face with T1D (e.g., constant monitoring of blood glucose, daily insulin injections, and restricted diets). The beginning of the messages includes a brief recap of the person's initial diagnosis of T1D. The stories of diagnosis ranged from the person's initial thoughts to family reactions, and they all encompass how the person's life was changed. For example: "Oh it's probably just the flu, is what my parents thought right before I was diagnosed with type 1 diabetes. As a 12-year-old, I knew nothing about diabetes, and neither did my family. It was a hard transition from being a kid who could eat and do whatever he wanted to now being told to stop what I'm doing and make sure I check my blood sugar."

The stories then move to growing up with T1D and the daily struggles each person faces (middle). Conflict is one of the most important parts of a health narrative as it is the turning point in which a person can fix their mistakes and adopt the appropriate desired health behaviors (Thompson & Kreuter, 2014). The following conflicts were focal to the stories: erratic blood sugar levels, with a primary emphasis on high blood sugar; consequences due to poor management such as potential loss of eyesight, potential denial of a driver's license, frequent hospitalization; negative outcome expectations such as fear of pulling out a blood glucose meter or injecting insulin in public or disclosing the disease to friends due to potential social stigma; and general lifestyle issues that come with being a teenager such as sports, extracurricular activities, school, and hanging out with friends (see Table 1 for conflicts). While some conflicts naturally overlapped – for example, high blood sugars and poor glycemic control leading to potential complications – most narratives focused solely on one. The stories conclude with a change in health behavior and justification for why that behavior has been successful.

While there is no direct resolution for the conflict of having T1D, given it is a lifelong, incurable disease, there are still several conflicts to disease management that arise and can be overcome. This includes adopting behavioral skills such as testing blood sugar more frequently, utilizing social support such as communicating the disease with friends and doctors, and accepting and embracing diabetes as part of their everyday lives. The resolution to the conflict occurs at the end of each narrative and leaves an upbeat message about how something (depending on the conflict) is better now that the person changed their behavior or attitude. Additionally, a clear, well-defined resolution as to how this behavior positively affected the situation has also been shown to increase message effectiveness (Boeijinga et al., 2017; Thompson & Kreuter, 2014).

Next, each story has a specific character. The characters in the narrative messages are college students with T1D; all of whom were diagnosed when they were younger. More importantly, each character had T1D while in adolescence, which is directly relatable to the target audience. The narratives go in depth for how the character's attitude, beliefs, and behavior toward T1D developed as they grew older. For example, one narrative talks about how the character was committed to managing T1D when first diagnosed; however, after a few months, she quickly experienced diabetes burnout and struggled to properly manage her blood sugar. This led to decreased self-efficacy and fewer performances of the desired behaviors such as frequent blood glucose testing. Ultimately each narrative has a resolution to the specific conflict, but the narrative develops the character and explains the progression in his or her T1D management.

The T1D narratives were written in first person, as first person health narratives have been shown to be better received by target audiences compared to third-person health narratives (de Graaf, Sanders, & Hoeken, 2016). Each story was about 450 words, which is an appropriate length for print narratives that have shown effects for health behavior change (Shen et al., 2015).

Phase II: Production & Message Pretesting

To understand how these narrative messages were perceived before final production, adolescents with T1D were recruited for message pretesting.

Adolescent Pretesting Recruitment and Procedures

Adolescents with T1D (*n* = 8) were recruited from the same pediatric endocrinology clinic used in phase 1. All participants had to be between the ages of 12 and 17, and to have had T1D for at least three months to ensure that they received adequate education on the basics of diabetes management (i.e., the importance of blood glucose testing and insulin administering). Of the 8 participants, four were male and four were female. Five were White, two were Hispanic or Latino/a, and one was African American. Average age was 14.62 (*SD* = 1.51). Age of T1D diagnosis ranged from 6 to 15 (*M* = 10, *SD* = 3.21). Four used an insulin pump and four used MDI for insulin delivery. Four used continuous glucose monitors (CGM), while four did not. The average number of blood sugar checks per day was *M* = 3.38 (*SD* = 2.24), which is less than the clinically recommended four to six times per day.

Participants were identified by the hospital staff based on the aforementioned criteria, and each evaluated messages during their appointment. Each adolescent signed a youth assent form, and the parent(s) signed a consent form. All interviews were audio-recorded and transcribed for data analysis. During the interaction, each participant saw two of the five messages in a random order based on counterbalancing randomization. After reading each message, participants answered a short 8-item perceived message effectiveness (PME) questionnaire, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). The PME scale (Appendix B) assessed how participants thought the messages affected their self-efficacy, cognitive elaboration, motivation to act, and behavioral intentions to improve their diabetes management and test their blood sugar more frequently (Noar et al., 2018). Sample items included, “This story gives me the confidence to have better control over my type 1 diabetes management” and “This story gives me good reasons to check my blood sugar more often.” The scale was evaluated for internal consistency and was highly reliable (α = .91).

After completing the questionnaire, each participant was involved in a semi-structured interview and answered questions about the messages (Appendix C). Sample questions included, “What did you think about the story?” and “Was there anything in the story that was effective at getting you to better manage your type 1 diabetes? If so, what?” Participants were also asked about areas for improvement of the message; if they understood the lesson of the story (e.g., you can overcome challenges and get better control over your T1D); if the message was relevant to what they were going through as adolescents; if the messages were too long; and at what age would this message would best work for them (e.g., when you were younger). After the first message was read, the entire process was repeated for the second message. At the end of the interaction, each participant was asked where they would like to see messages related to T1D management (i.e., on social media, on the Internet, or at a doctor’s office). Each participant was given a $10 gift card for participation. Of the five messages created, four were viewed a total of three times and one was viewed four times, per the randomization process.

Findings

Perceived Message Effectiveness

The five messages scored relatively highly on the PME measure. David’s story (age 20, diagnosed at age 12), which focused on interacting with friends, scored highest with a mean of 4.54 out of 5 (*SD* = .17), followed Sarah’s story (age 21, diagnosed at age 4), which focused on diabetes acceptance (*M* = 4 .31, *SD* = .22) and Samantha’s story (age 22, diagnosed at age 6), which focused on frequent hospitalizations (*M* = 4.17, *SD* = .18). The two lowest-rated messages were Abigail’s story (age 21, diagnosed at age 14), which focused on food intake and carbohydrate counting (*M* = 3.96, *SD* = .38) and Jay's story (age 27, diagnosed at age 11), which focused on low blood glucose levels (*M* = 3.88, *SD* = .47).

Semi-structured Interviews

After evaluating each message, the participants were asked how relevant the messages were to them. All eight participants said that the messages sounded like something they were going through in their own lives. This sentiment was expressed for all topics within the narratives. For example, one 14-year-old girl who was diagnosed when she was 6 related to the idea that her friends thought the disease was her fault or was like what her grandparents had (referring to type 2 diabetes). Another participant, a 15-year-old girl who was diagnosed when she was 10, said, "I can relate to most of the stuff she [the narrative character] said, like she got in a bad habit of not doing what she needed to do which is what I went through." A 14-year-old male who was diagnosed at age 11 said that he experiences problems with not being able to participate in sports, which is what one character's story involved. Additionally, when reading about negative outcomes due to poor management such as hospitalization due to diabetic ketoacidosis, a 16-year-old male said, "I can really relate to it because the stuff she [the narrative character] used to do and went through, I went through it. The ketoacidosis has happened to me multiple times… I felt that."

Additionally, most participants remarked how the messages would be effective in motivating them to take better control of their T1D management. A 17-year-old male who was diagnosed at 15 explained that the narratives outlined what was needed to be done to better improve management (e.g., checking blood glucose more frequently and talking with friends about the disease). Even though he knew what he was supposed to be doing, reading about someone else who had gone through something like him with poor management made him think about how he could change. To that point, each participant was able to properly identify the steps that the narrative characters took to improve their management, such as checking blood glucose more frequently, being more open about T1D with their friends, and having a better outlook about the disease.

In general, participants understood the goals of the message and said that they would be beneficial in helping their management. Negative feedback was sparse, but it was taken into consideration, and the messages were revised to reflect their preferences. For example, some participants wanted the messages to go further in-depth on the behaviors that the person with T1D engaged in to improve his or her management, and some words were simplified or changed for clarity. Additionally, the narrative characters' names were later changed to more racially ambiguous names (e.g., Vanessa, Taylor, and Michael).

All five messages were evaluated by the target audience, but only the three highest-rated messages in this study – Samantha, David, and Sarah – were retained to move forward as part of the quantitative experimental study performed in Aim 2. One message was dropped because it focused on low blood sugars, and the participants remarked that low blood sugar was not a primary concern, given they usually struggled with high blood sugar, which is consistent with past literature (Hood et al., 2009; Ziegler et al., 2011). The other message was removed because it was similar to the others but the feedback was not quite as positive – based on PME scores – as the other messages that were retained.

Discussion

This two-phase formative research study developed narrative messages targeted to adolescents with T1D and pretested them among this hard-to-reach target audience. The first phase involved recruitment of college students to assess their experiences living and growing up with the disease. This approach proved successful for providing real, lived experiences with the struggles – and subsequent successes – of managing T1D. These stories were successfully crafted into promising narratives to promote better glycemic control for adolescents with T1D.

The five narrative messages developed in this study had both common and unique elements. Common elements included: the initial shock about the diagnosis and subsequent lifestyle change; concern about social situations; struggles with poor management; and conflict that arose that made each participant re-evaluate how they were taking care of a lifelong disease. Differences included what the conflict entailed and how each person responded to the struggles of T1D. For example, some found that talking with others and having more reliance on friends was the reason behind their improved management, while others focused more on taking a proactive style toward management (e.g., checking more often in order to detect highs and lows before they happen). Some also found that living with diabetes for an extended period of time was the best way to cope with the disease (average time with T1D was 11 years), which is consistent with past research (Acuff & Jabson, 2017).

Past studies that showcase the effectiveness and utility of formative message testing range from HPV vaccinations (Shafer, Cates, Diehl, & Hartmann, 2011) to physical fitness initiatives (Berkowitz et al., 2008), to health-based television workshops (Palmer, 1981); however, not many examples of message testing exist specifically for narratives. Because more successful health messages and campaigns utilize formative research and message testing (Atkin & Freimuth, 2013; Noar, 2006), this study sought to follow best practices for formative research involving narratives.

When looking at how theory can inform messages, SCT proved a viable tool. The narratives in this study had real characters who served as the models for vicarious learning from the adolescents. A key tenet of SCT is the ability for modeling to influence behavior change (Bandura, 1986). Past studies have shown that narratives can be effective in boosting attitude, self-efficacy, and behavioral intentions for activities like mammograms (Kreuter et al., 2010) or giving up unhealthy foods (Niederdeppe et al., 2011). Additionally, Murphy and colleagues (2013) showed that narratives were better than traditional, informational messages for enhancing knowledge and attitudes about health behaviors. The narratives in this study draw upon personal experiences to a) highlight personal relevance for the adolescents and b) showcase what behaviors need to be taken to overcome challenges to managing T1D. Additionally, these narratives highlight self-efficacy and building confidence to properly manage T1D. Ultimately, this formative research showcases how these T1D narratives may be effective because they provide compelling characters who have gone through similar circumstances as the intended audience to enact behavior change.

Another important finding was that the PME ratings were consistent with the qualitative feedback. Adolescent participants talked favorably about the messages in interviews, and all messages were rated relatively highly, with the lowest being rated a 3.88 out of 5. However, the message that highlighted low blood sugar was rated as the least effective by the target audience. This is unsurprising, as only 14% of adolescents with T1D achieve their glycemic goals of an HbA1c lower than 7.5 (Hood et al., 2014). Thus, it is reasonable to assume that messages pertaining to low blood sugar (which is associated with lower HbA1c levels) would impact only a small proportion of adolescents with T1D. It would seem that messages highlighting high blood sugar and the subsequent behaviors to reduce these high numbers (e.g., insulin administering and talking more with doctors about treatment plans) would be more beneficial for this population. This study demonstrates how the winnowing process used in formative development can result in what appear to be messages with the most promise for impact.

Finally, adolescents in this study reported enjoying hearing stories about college students with T1D, as this was a next step in their life. Using college students as message sources for T1D may be an optimal route when dealing with adolescents, as they seem to be relatable to the adolescents but are less likely to be met with resistance the way that parents or healthcare providers might be. These messages also exhibited that while growing up with T1D is challenging, there are positive outcomes that can emerge if the disease is managed properly. Furthermore, even the college students who were deemed by the endocrinologists as having good management still struggled when they were younger. This shows that problems with T1D are not a life sentence, and that there are avenues in which people can improve.

Limitations

While this formative approach was successful in creating narratives for adolescents, there were some challenges. Recruitment for college students with T1D was difficult, and the participants were recruited through convenience sampling. The college students whose experiences were used for the narratives may not be representative of all children and adolescents growing up with T1D. Additionally, recruitment for the adolescents was challenging, and the recruitment process took two months and frequent visits to the endocrinology department. Participants were shown messages during their doctor’s appointment, and thoughts about T1D management may have been more salient and top-of-mind given the recruitment location. Also, these participants’ perspectives on the messages are not necessarily representative of all adolescents with T1D.

Conclusion

This study worked with a hard-to-reach population to develop messages that resonate with adolescents with T1D, based on personal stories. Overall, these messages were perceived as fairly effective. Narratives are generally an effective health communication tool, and there remains an opportunity to use them for better T1D management. Narratives for T1D should be driven by recalling personal experiences, creating influential social models, acknowledging challenges to T1D management, outlining proper behavior change, and, ultimately, providing hope and positive outcome expectations. The creation of these narratives may provide a beneficial solution for healthcare practitioners who are seeking to improve adolescents' T1D management. Quantitative testing needs to be conducted, however, to examine these messages' efficacy in changing psychosocial outcomes such as outcome expectations, self-efficacy, and behavioral intentions, as well as management behaviors such as blood glucose testing.

Aim 2: Testing the Impact of Narrative Messages on Adolescents' Type 1 Diabetes Management

Narrative messages can be influential tools for motivating individuals and getting them to adopt a health behavior (Hinyard & Kreuter, 2007). Narrative messages have the potential to communicate personal experiences with a particular disease through a story arc. Narrative messages can also be effective in capturing an audience’s attention, improving their understanding, and enhancing recall of a message (Kreuter et al., 2010). Additionally, narrative messages can motivate people to act because characters in the narratives may serve as a positive example and successfully show how to overcome conflict (Green, 2006).

Narrative communication has shown its effectiveness and utility in health communication, and there remains a need to understand how narrative messages work specifically for adolescents with T1D. Research has shown that adolescents have the poorest T1D adherence of any age group under 18, and this poor management can include a lack of blood sugar testing, skipping insulin injections, poor diet, lack of exercise, and reduced communication with parents and doctors (Chiang et al., 2018; Silverstein et al., 2005; Ziegler et al., 2011). There are also several psychological barriers to management, which often overlap. Furthermore, because only an estimated 132,000 people under the age of 18 have T1D, there are few peers who have the disease, and adolescents may not have a role model or similar others who can showcase how to manage T1D. Narrative messages remain an opportune avenue for exposing adolescents to potential role models by detailing stories of someone living with T1D, facing barriers, adopting behaviors to overcome these barriers, and ultimately having a successful outcome and improved outlook on their quality of life.

This dissertation involves creating and testing narrative messages for adolescents with

T1D ages 12-17 to improve management of their lifelong disease. The narrative messages, developed and pretested through extensive formative research outlined in Aim 1, seek to improve their T1D management by focusing on constructs that have been shown to predict improved glycemic control: increased self-efficacy to manage (Iannotti et al., 2006); improved outcome expectations for management (Iannotti et al., 2006); increased diabetes acceptance (Schmitt et al., 2018); and reduced stress and burnout perceptions (Mulvaney et al., 2011a). Improving these outcomes should lead to changes in behavioral intentions to manage T1D.

While the aforementioned self-efficacy, outcome expectations, diabetes acceptance, and stress and burnout perceptions variables have been shown to be associated with improved adherence and glycemic control of T1D, the current study examines the extent to which communication can change these mediators of behavior by using narrative messages. Through the use of an online experiment, this study sought to bridge the gap in T1D messages and understand if narrative messages created to target self-efficacy, outcome expectations, diabetes acceptance, stress and burnout perceptions, and behavioral intentions lead to improvements in these outcomes and, ultimately, improved T1D management. This study tests narratives against standard of care messages currently in use at the pediatric endocrinology clinic at the University of North Carolina Children’s Hospital, which, at the time of this dissertation, was ranked as the 16th-best pediatric endocrinology clinic in the United States (U.S. News & World Report, 2019).

Hypotheses and Research Questions

Message evaluation

Narrative messages can increase emotion and transportation as mechanisms of impact through the use of personal relevance, shared experiences, and a reduction in counter-arguing. Narrative messages are particularly effective when participants identify with characters, leading to deeper engagement. While PME is typically used in formative research and message development, it is also an important tool for experimental research, as it may predict actual message effectiveness over time (Noar et al., 2018; Yzer et al., 2015). This leads to the following hypotheses:

H1: Narrative messages will lead to increases in positive emotion and hopefulness about T1D relative to the standard of care messages.

H2: Narrative messages will lead to more transportation and immersion into the narrative messages relative to standard of care messages.

H3: Narrative messages will be perceived as more effective than standard of care messages.

RQ: To what extent will participants wishfully identify with the characters in the narratives?

Psychosocial outcomes

Narrative messages can increase self-efficacy and improve outcome expectations by providing stories of a person with lived experiences with T1D who have gained confidence and skills needed to ultimately be successful in their management. Additionally, for other psychosocial barriers for adolescents with T1D, narrative messages can improve feelings of acceptance toward their disease as well as reduce perceptions in the stress and burnout that accompany T1D. Thus, this leads to the following hypotheses:

H4: Narrative messages will lead to increases in self-efficacy relative to standard of care messages.

H5: Narrative messages will lead to increases in positive (H5a) and decreases in negative outcome expectations (H5b) relative to standard of care messages.

H6: Narrative messages will lead to increases in diabetes acceptance relative to standard of care messages.

H7: Narrative messages will lead to decreases in stress and burnout perceptions relative to standard of care messages.

Both theory and empirical research find behavioral intentions to be a strong predictor of behavior. If narratives impact the psychosocial outcomes above, that should translate into changes in behavioral intentions for managing T1D. This leads to the following hypotheses:

H8: Narrative messages will lead to increases in overall intentions to improve diabetes management relative to standard of care messages.

H8a: Narrative messages will lead to increases in intention to engage in more interpersonal communication about T1D management relative to standard of care messages.

H8b: Narrative messages will lead to increases in intention to take actions to improve T1D management relative to standard of care messages.

Methods

Participants

Adolescents (*N* = 248) ages 12-17 with T1D were initially recruited through a variety of methods, but the final analytic sample was *N* = 191. Participants were recruited by in-person visits during their doctor's appointments at the pediatric endocrinology clinic at University of North Carolina Children's Hospital (*n* = 45); through social media sites dedicated to parents of adolescents with T1D (e.g., Facebook groups such as "Parents of Children with Type 1 with Diabetes") (*n* = 20); online forums (e.g. "Children with Diabetes") (*n* = 2); and through an online panel of participants purchased from Qualtrics (*n* = 181). An a priori sample size calculation using G*Power (Faul, Erdfelder, & Lang, 2009) found that, to achieve 80% power for this experiment based on an alpha level of .05, with an estimated small-to-moderate effect size ($d = .40$), $N = 200$ adolescents were needed. This analysis was based on effect sizes from other similar studies that have utilized narrative messages (Braddock & Dillard, 2016; Shen et al., 2015; Zebregs et al., 2015).

Because this study involved adolescents, parents first had to be consulted for parental consent. For in-person visits at the doctor's office, the endocrinologist, diabetes educator, social worker, or nurse asked the parents if they would be willing to let their child participate in a research opportunity involving adolescents with T1D. If the parents agreed, I entered the room to broadly outlined the scope of the study and provide an iPad to the parent. The parents read the consent form on the screen and agreed to let their child participate in the study. The parents then passed the iPad to the adolescent, where he or she read and agreed to the youth assent form. During most endocrinology appointments, patients typically have at least 15 to 20 minutes of waiting for the doctor to review their blood glucose data through the insulin pump or blood glucometer (McAdams & Rizvi, 2016). During this time, participants were able to take and complete the study. If the participant did not have enough time to finish during this waiting period, then he or she was allowed to continue after the appointment was finished.

Through online recruitment via Facebook and online forums, a direct message was sent to page administrators explaining the study. The administrator either allowed me to post a recruitment message with contact information in which parents of adolescents with T1D could request more information about the study to determine if they would be interested in allowing their child to participate, or the administrator posted a message about the study themselves. Once parents reached out to participate, verification about whether they had a child with T1D was sent. This included questions about the age of their child, age of diagnosis, and the particular online page where the parent learned about the study (e.g., “Parents of Children with Type 1 Diabetes”). Once verified, a unique link to the study was sent to the parent. The parent was then advised to read and agree to the parental consent form before allowing the child to participate.

Recruitment from the Qualtrics online panel went through a variety of verification checks to ensure the participants were between the ages of 12 and 17 and had T1D. Because this study involved adolescents, Qualtrics had to first contact parents for parental consent. To ensure the parents who consented had a child with T1D, Qualtrics asked several screening criteria such as "How many children do you have," "What are the ages of your children," and "Does your child have any of the following conditions (with T1D being an option)?" The ages had to range from 12-17, and T1D had to be selected as one of the conditions in order for a parent to allow their child to participate. Once there was verification that the adolescent fit the study criteria, participants were able to complete the study.

To ensure data quality from online participants through both Qualtrics and Facebook, I established three criteria. First, participants’ length of time it took to complete the study was examined. Responses that took less than 7 minutes were flagged for further examination, as pretesting of the study indicated that it should take an average person anywhere from 7 to 10 minutes to complete. This below-7-minute mark was set to ensure participants did not rapidly go through the study. Second, the cued recall and end-of-survey qualitative additional thoughts were examined. Participants who did not answer these questions or those who typed random letters were removed, because there was no way of verifying they read the messages. Additionally, the cued recall questions asked participants to mention three things they remember from the messages. Comments such as “outstanding,” “great,” or “awesome" were also removed because they were not about specific parts of the messages. Finally, the consistency of response answers was reviewed. If a person exclusively answered one response choice for all questions (e.g., strongly disagree/extremely confident/very often), those people were removed. This criterion only came into effect if either of the first two criteria were marked. If participants failed two of the three quality control measures, then their responses were removed entirely from the sample. There were no data quality issues with participants from the pediatric endocrinology clinic and online forums, but there were some issues among both the Qualtrics and Facebook samples. Among the 181 participants initially recruited from the Qualtrics panel, 128 (71%) were kept in the final study sample. Among the 20 participants recruited from Facebook, 16 (75%) were kept in the final sample. This led to a final analytic sample across all recruitment methods of *N* = 191.

Experimental Design and Procedures

This study used an online two-arm randomized experimental design with two conditions: narrative messages and standard of care messages. Participants (*N* = 191) were randomly assigned to one of the two conditions. Random assignment was verified through chi-square analyses of the categorical variables and t-tests that revealed no significant differences by condition assignment for gender, age, race, recruitment source, insulin delivery method, CGM usage, number of blood glucose checks per day, HbA1c level, length of diagnosis, or age at diagnosis.

This online experiment was delivered via Qualtrics (see Appendix F). After parental consent and youth assent, the survey began with basic demographic questions about the adolescent, such as age, gender, race, ethnicity, and socioeconomic status (SES) (determined by free or reduced lunch). Participants were then asked T1D-specific information such as age of diagnosis, the average number of times they check their blood glucose or view their CGM (if applicable) per day, insulin delivery method (i.e. pump vs. shot), the most recent HbA1c (if known), and the frequency in which they receive T1D information from sources such as parents/guardians, doctors, school nurses, friends, diabetes websites, social media, others with T1D, and diabetes advocacy organizations.

After answering demographic questions, participants were then randomly assigned – via Qualtrics – to either the narrative or standard of care condition where they would see a set of three messages. The order of the messages was randomized for each participant within each condition. To ensure participants had enough time to fully read the messages, participants were not allowed to advance to the next screen until at least 30 seconds had passed, but they could take as long as needed. After viewing all messages, adolescents were immediately asked to recall three things that stood out from the messages. Next, participants were asked where they would like to see the messages they just viewed, if they were to be given to people with T1D.

Participants then answered message evaluation questions regarding emotions, transportation, and PME. Only participants in the narrative condition were asked about wishful identification, as the standard of care messages did not have specific characters. Participants were then asked the psychosocial outcomes – i.e., self-efficacy, negative outcome expectations, positive outcome expectations, diabetes acceptance, stress and burnout perceptions, and behavioral intentions. The order of items within each set of questions was randomized. At the conclusion of the study, participants were given the chance to provide any additional thoughts about the messages. All participants were given a $5 gift card or the standard panel incentive for participation (Qualtrics). Participants recruited from the endocrinology clinic, Facebook, and forums were also entered for a chance to win one of three $50 gift cards. All procedures used in this study were approved by the Institutional Review Board at the University of North Carolina at Chapel Hill.

Message Stimuli

Narratives. The three narrative messages used in this online experiment were developed from real stories from college students, ages 20-22, who grew up with T1D and faced similar challenges to the adolescent target population. The narrative messages included the steps they took to overcome the challenges and how this led to healthier behaviors. The narrative messages were text based and did not include any graphics or a depiction of a person with T1D, as this study was designed to test the effects of the narrative message content. The narratives averaged 450 words each, which is an appropriate length supported by prior evidence of effectiveness (Shen et al., 2015). Additionally, pictures of people with T1D were not included in the message design as these may have served as a confound to the experiment, potentially influencing participants' thoughts and feelings toward the messages (Zillmann, Gibson, & Sargent, 1999). The theoretical foundation for message development was Bandura's (1986) social cognitive theory, which posits that modeling and vicarious learning from others perceived as similar to a person can lead to improved psychosocial outcomes. In this study, these outcomes were identified as self-efficacy, negative outcome expectations, positive outcome expectations, diabetes acceptance, stress and burnout perceptions, and behavioral intentions.

The narrative messages were thoroughly tested through formative research involving adolescents with T1D to ensure that they resonated with the target audience. This formative research process improved the clarity and effectiveness of the messages, based on feedback from the target audience, while also removing two potentially ineffective messages (see Aim 1). All narrative messages can be viewed in Appendix D.

Standard of Care. Non-narrative standard of care messages were adapted from current materials being used by the pediatric endocrinology clinic at the University of North Carolina

Children’s Hospital, which currently sees approximately 60 adolescents ages 12-17 with T1D. These messages were developed by a certified diabetes educator (CDE), in conjunction with a team of endocrinologists at the hospital. These messages appear in various educational materials that are used by endocrinologists, CDEs, nutritionists, and social workers who interact with adolescents during their visits to the clinic. These three messages vary slightly, but all include basic information about living with T1D, the clinical importance of checking blood glucose, and goals of treatment. For example, one message states, “The goal of taking care of your diabetes is to feel well today, to keep doing the things that you enjoy, and to avoid complications in the future.” Another uses an analogy that compares managing T1D to driving and taking care of a car: “To know how fast you are going, you look at the numbers on the speedometer. If you see that you are going above the speed limit (your *target blood sugar*), you step on the brake.” The last message breaks down the importance of specifically checking blood glucose and the outcomes it will have: “Checking can help you reach your target blood sugar. Keeping blood sugar near normal most of the time helps lower the chance of complications.”

As currently used in clinical practice, these messages are on plain sheets of paper, and only two have small graphics: a car for the car analogy and an image of fingers with a glucometer to indicate checking blood glucose. The images were removed for this study and were designed with the same colors and fonts as the narrative messages, as to keep the messages as similar as possible to the narrative condition. These messages were shorter than the narratives, ranging in length from 135 to 202 words; however, in order to provide participants in the study with real-world materials and provide results that bolster ecological validity, these messages were not enhanced to increase the length. Finally, these messages from the clinic were chosen because past standard of care experiments have been shown to be beneficial due to the ability to determine if the treatment is, in fact, superior or inferior to what the participants actually receive (Freedland, Mohr, Davidson, & Schwartz, 2011). All standard of care messages can be viewed in Appendix E.

Measures

The measures for this study are broken into two categories: message evaluation and psychosocial outcomes. Factor analyses were run on each of the measures to determine how the items within the scales loaded together. Maximum likelihood (ML) was chosen as the extraction method, based on recommendations from prior literature stating ML is supported when data is normally distributed (Carpenter, 2018). The eigenvalue and KMO value for measure evaluation outcomes were: emotion (eigenvalue = 2.52; KMO = .75); transportation (2.81; .82); PME (3.45, .86); and wishful identification (2.27; .69). All items in these scales remained. The eigenvalue and KMO level for psychosocial outcomes were: self-efficacy (3.58; .87); positive outcome expectations (3.08; .80); negative outcome expectations (3.39; .86); diabetes acceptance (1.80; .66); and stress and burnout perceptions (2.03; .66). One item ("diabetes makes me sad") was removed from the diabetes acceptance scale because it failed to score on a meaningful factor, and it reduced the reliability of the scale. The factor analysis for behavioral intention (KMO = .79) identified two independent factors: factor 1 about action-based items (eigenvalue = 3.21) and factor 2 about interpersonal communication (eigenvalue = 1.32). See Table 5 for factor loadings based on scale items. A correlation matrix with all variables can be found in Table 6.

Message evaluation outcomes

Emotion (hopefulness). Emotion was measured by a 3-item scale developed by Nabi and Myrick (2018). Participants rated the impact the set of messages had on their emotions, on a 5-point response scale ranging from from 1 (not at all) to 5 (extremely). An example item was

“The set of messages I just read made me feel hopeful.” These three items were averaged to create a single composite scale (α = .90, *M* = 3.76, *SD* = .99).

Transportation. Transportation measured the psychological state of being immersed in the messages, using a 5-item Transportation Scale-Short Form developed by Appel, Gnambs, Richter, and Green (2015). Participants were asked how much they agreed, ranging from 1 (strongly agree) to 5 (strongly agree), that they were transported into the set of messages they read. Sample items included, “I could picture myself in the scene of the events described in the messages” and “While reading the messages I had vivid images of what was happening.” These five items were averaged to create a single composite scale (α = .80, *M* = 3.96, *SD* = .69).

Perceived message effectiveness. Perceived message effectiveness (PME) refers to the participant’s perception of the persuasive value of the set of messages. These items were created from recommendations for measuring PME based on Noar and colleagues’ (2018) systematic review. The scale was made up of five items measured on a 1 (strongly disagree) to 5 (strongly agree) response scale. Example items were “motivated me to get better control over my diabetes management” and “gave me good reasons to get better control over my diabetes management.” These five items were averaged to create a single composite scale (α = .88, *M* = 4.11, *SD* = .72).

Wishful identification. Wishful identification measured the extent to which participants wanted to be like the characters in the narrative messages. This measure was not asked of the standard of care messages. This 3-item scale was adapted from Hoffner and Buchanan (2005). Participants indicated the extent to which they agreed or disagreed with each statement on a 5-point response scale ranging from from 1 (strongly disagree) to 5 (strongly agree). An example item was “I wish I could be more like the people in the messages.” These three items were averaged to create a single composite scale (α = .83, *M* = 3.86, *SD* = .72).

Cued recall. After reading each set of three messages, each participant was asked to write three things that stood out to them from the messages.

Psychosocial outcomes

Self-efficacy. Self-efficacy was measured on a 6-item Self-efficacy for Diabetes Management scale adapted from Iannotti et al. (2006). Participants rated their confidence, ranging from 1 (not at all confident) to 5 (extremely confident), in performing a particular diabetes management tasks in various scenarios such as when the adolescent is busy ("I am confident I can check my blood sugar even when I'm really busy"); working with doctors ("I am confident I can talk to my doctor about any problems with my diabetes"); and during times of stress ("I am confident I can find ways to deal with feeling frustrated by my diabetes"). These six items were averaged to create a single composite scale (α = .86, *M* = 3.92, *SD* = .70).

Outcome expectations. Outcome expectations captured positive and negative dimensions adapted from the Outcome Expectations of Diabetes Self-Management scale (Iannotti et al., 2006). When creating this scale, Iannotti and colleagues (2006) found that the two measures were not reliable as one overall outcome expectations scale. Thus, positive and negative outcome expectations were computed as independent scales. Both scales assessed the extent to which participants assessed how much they agreed, ranging from 1 (strongly disagree) to 5 (strongly agree), with statements about the outcomes of proper management. For both positive and negative outcomes, participants were asked about a variety of scenarios that would occur with the stem, "If I were to take care of my diabetes like I'm supposed to, I would..."

The positive outcome expectation scale consisted of seven items, such as "have fewer high blood sugars." These seven items were averaged to create a single composite scale (α = .77, *M* = 4.18, *SD* = .51). The negative outcome expectation scale consisted of 5 items, such as "be on too strict of a schedule." Higher negative outcome expectations scores meant meant more negative beliefs about their T1D-management actions. These five items were averaged to create a single composite scale (α = .88, *M* = 2.69, *SD* = 1.02).

Diabetes acceptance. Diabetes acceptance intended to capture positive and negative aspects of having diabetes, with items adapted from Schmitt et al. (2018). Originally this study used a 4-item scale, broken into positive and negative acceptance, participants assess the extent to how much they agree, ranging from 1 (strongly disagree) to 5 (strongly agree), with statements about the having diabetes. The positive acceptance items included "Diabetes is a normal part of my life." The only negative outcome acceptance item was "Diabetes makes me sad," which was then reverse-scored. However, this scale consisting of the positive and negative items proved to be unreliable (*α* = .55), and the negative item was dropped from analysis. Additionally, an ML factor analysis showed that this item did not load on a meaningful level with the other three items. The remaining three items were averaged to create a single composite scale (α = .67, *M* = 4.11, *SD* = .72).

Stress and burnout perceptions. Stress and burnout perceptions about diabetes management was measured by a 3-item scale adapted from the Barriers to Diabetes Adherence scale (Mulvaney et al., 2011a). Participants rated how much they agreed, ranging from 1 (strongly disagree) to 5 (strongly agree), with perceptions of diabetes management stress and burnout. A sample item included "Living with diabetes makes me feel stressed, anxious, or overwhelmed." Higher stress and burnout scores meant meant more negative feelings about their T1D management. These three items were averaged to create a single composite scale (α = .76, *M* = 3.14, *SD* = .94).

Behavioral intention. Behavioral intention measured the intent to take better control of one's diabetes management over the next three months. The three-month time period was chosen because that is typically the timeframe that healthcare providers use to evaluate diabetes management through a clinic visit and an HbA1c test. On an overall 7-item behavioral intention scale, participants rated how much, ranging from 1 (never) to 5 (very often), they plan to perform a variety diabetes management tasks. Sample items included: "Check my blood sugar (or look at my CGM) at least 5 times per day" and "Talk to my doctor about how I can better control my diabetes." These seven items were averaged to create a single composite scale (α = .79, *M* = 4.04, *SD* = .60). However, the ML factor analysis for these items found that the total scale could also be broken down two factors: action-based items such as checking blood glucose or looking at a CGM, as well as interpersonal items such as talking with significant others about the participant's T1D management. Thus, two separate scales were created. The three interpersonal communication items were averaged to create a single composite scale (α = .75, *M* = 3.71, *SD* = .82). The four action-based items were averaged to create a single composite scale (α = .77, *M* = 4.28, *SD* = .62).

Analysis Strategy

The purpose of Aim 2 was to evaluate the effectiveness of narrative messages compared to the non-narrative standard of care messages that are currently being used by the pediatric endocrinology clinic at the University of North Carolina Children's Hospital when dealing with adolescents with T1D. Before analysis began, the data were inspected and cleaned. Then, responses to the cued recall prompts after the set of messages were viewed to evaluate whether the participants read the messages. Independent-samples *t* tests were conducted to examine if the narrative message condition scored significantly higher on a variety of outcomes, relative to the standard of care messages. H1, H2, H3, and wishful identification focused on how participants evaluated the messages, while H4, H5, H6, H7, and H8 focused on the psychosocial outcomes assessed in this study.

Results

Participant demographics can be found in Tables 2 and 3. Ages for the adolescents with T1D ranged from 12-17. Gender was almost evenly split, with 97 females (51%) and 94 males (49%). The average age of child was 14.62 years old (*SD* = 1.55), and the age of T1D diagnosis ranged from less than a year old to 16 years old. The average age of diagnosis was 9 years old (*SD* = 3.92); thus, the average length of time managing T1D was almost six years. Participants self-reported that they checked their blood glucose (either through finger pricks or by looking at their CGM) an average of 5.44 times per day (*SD* = 3.69), which is adherent to the clinically recommended minimum of at least four per day. Average checks per day ranged from 0 to more than 15 times per day. The average self-reported HbA1c was 8.08 (*SD* = 1.85). Clinical recommendations for target HbA1c levels for adolescents is 7.5 or below; thus adolescents in this study were generally classified as uncontrolled regarding their T1D. For insulin delivery method, 109 (57%) used an insulin pump and 82 (43%) performed multiple dose injections (MDIs) through either a needle or an insulin pen. A majority of participants (68%) used a CGM as part of their T1D management. Evidence suggests that using technology such as an insulin pump and CGM is an additional tool for diabetes management that can ultimately improve health outcomes in youth with T1D (Jamiołkowska et al., 2016; Lal & Maahs, 2017), so it is reasonable to suggest that a majority of adolescents in this study had the necessary technology to achieve optimal control of their T1D. Participants also reported they most frequently receive T1D information from doctors and parents (Table 4).

A majority of the participants were White (69%), followed by Black or African American (15%), and Asian or Pacific Islander (4%). Nine percent were mixed race and 3% elected to not answer their race. Across all participants, 27 (14%) were Hispanic. Sixty-two percent (*n* = 119) of participants said they would pay full price for lunch, 16% (*n* = 30) would pay a reduced price, 22% (*n* = 41) said their lunch would be free, and one participant elected not to answer this question. Based on these demographics, the sample appears to be somewhat diverse in terms of race and ethnicity, as well as SES.

Cued Recall

Participants were given at least 30 seconds to view each message before being allowed to continue forward in the study. Narrative messages were longer than the standard of care messages, and this was reflected in the data. Taylor's story was viewed the longest, with an average of 95.71 seconds (*SD* = 92.07, median = 65.01), followed by Michael's story (M = 79.84, *SD* = 92.20, median = 58.41) and Vanessa's story (*M* = 68.49, *SD* = 46.64, median = 50.36). For the standard of care messages, the car analogy message was viewed the longest (*M* = 60.07, *SD* = 114.94, median = 39.58), followed by the message outlining reasons to check (M = 51.57, *SD* = 31.22, median = 41.23), and the message with a description of what a person with T1D has to do to manage the disease (*M* = 50.64, *SD* = 82.71, median = 35.83). Collectively, the average time to each narrative message was viewed was 81.35 seconds (*SD* = 55.66), whereas the standard of care messages were viewed an average of 54.09 seconds (*SD* = 51.17).

Cued recall was built into the study design as a manipulation check to determine if participants read the messages. All but four participants (98%) answered the cued recall questions. To gauge confirmed recall, two independent coders went through all 187 applicable responses to identify if they thought the participant was in the narrative or standard of care condition. Coder 1 was correct 93% of the time and Coder 2 was correct 90% of the time. The percent agreement between the two coders was high, at 89%. Based on these findings, it was clearly evident that the vast majority of the participants read the messages in their respective conditions.

Message Channel Preferences

After viewing the set of messages, participants were asked where they would like to see the messages, with options including at the doctor's office, from the school nurse, on diabetes-specific websites, on social media (e.g. Instagram, Facebook, Snapchat, and Twitter), on television, and from diabetes advocacy organizations such as the JDRF or American Diabetes Association. For narrative messages, more than half of participants preferred these messages to appear at doctor's offices (68%), on diabetes websites (59%), on social media (55%), and from diabetes advocacy organizations (52%). School nurses (49%) and television (44%) were not preferred by more than half of the sample. For standard of care messages, an overwhelming 84% preferred these messages to appear in the doctor's office, followed by social media (62%), diabetes websites (61%), diabetes advocacy organizations (57%), and school nurses (55%). Television (44%) was the only source not preferred by more than half of the standard of care condition (see Table 7). Because the standard of care messages were adapted from materials currently used by a pediatric endocrinology unit, it is fairly unsurprising that almost all participants felt this outlet was a good location for these messages.

Message Evaluation Outcomes

H1 predicted that the narrative messages would lead to increased hopefulness compared to the standard of care messages. Narrative messages (*M* = 3.86, *SD* = .92) scored higher than standard of care messages (*M* = 3.65, *SD* = 1.04), but this difference was not statistically significant; *t*(189) = 1.465, *p* = .145. H1 was not supported. H2 predicted that participants would be more transported into and involved with the narrative messages narrative relative to standard of care messages. The narrative messages scored higher (*M* = 4.01, *SD* = .76) than standard of care messages (*M* = 3.90, *SD* = .74), but this difference was not significant; *t*(189) = 1.058, *p* = .291. H2 was not supported. H3 predicted that the narrative messages would be perceived as more effective than standard of care messages. The narrative messages scored slightly higher (*M* = 4.13, *SD* = .74) than the standard of care messages (*M* = 4.10, *SD* = .69), but this difference was not significant; *t*(189) = .337, *p* = .337. H3 was not supported (see Table 8).

Additionally, wishful identification was measured only for the narrative condition, as there was no specific character in the standard of care messages with whom participants could identify. That is, narrative messages had specific characters (Vanessa, Taylor, and Michael), whereas standard of care messages were more generic (e.g., a person with type 1 diabetes). Participants in the narrative condition scored relatively high on wishful identification (*M* = 3.86, *SD* = .72), indicating the participants generally identified with the narrative characters.

Self-efficacy and Outcome Expectations Outcomes

H4 predicted that the narrative messages would lead to increases in self-efficacy relative to standard of care messages. Narrative messages scored slightly higher (*M* = 3.93, *SD* = .68) compared to the standard of care messages (*M* = 3.91, *SD* = .73), but this difference was not significant; *t*(189) = .249, *p* = .804. H4 was not supported.

H5 predicted that narrative messages would lead to increases in positive outcome expectations (H5a) and decreases in negative outcome expectations (H5b) relative to the standard care messages. For positive outcome expectations, standard of care messages scored marginally higher (*M* = 4.18, *SD* = .55) than the narratives (*M* = 4.17, *SD* = .48). However, these differences were not significant; *t*(189) = -.047, *p* = .963. For negative outcome expectations, participants who viewed narrative messages reported slightly lower negative outcome expectations (*M* = 2.68, *SD* = 1.06) than standard of care messages (*M* = 2.71, *SD* = .98). However, these differences were also not significant; *t*(189) = -.207, *p* = .836. Both H5a and H5b were not supported (see Table 9).

Diabetes Acceptance and Stress and Burnout Outcomes

H6 predicted that narrative messages would lead to increases in diabetes acceptance relative to standard of care messages. Standard of care messages scored higher (*M* = 4.16, *SD* = .66) than narrative messages (*M* = 4.03, *SD* = .74), but this difference was not significant; *t*(189) = -1.317, *p* = .189. H6 was not supported. H7 predicted that the narrative messages would lead to decreased stress and burnout perceptions relative to standard of care messages. The scale items had negative valence, so lower scores indicated less stress and burnout perceptions. Narrative messages (*M* = 3.13, *SD* = 1.04) were not significantly lower than the standard of care messages (*M* = 3.15, *SD* = .84); *t*(178.49) = -.120, *p* = .905. H7 was not supported (see Table 10).

Behavioral Intentions

H8 predicted that narrative messages would lead to increases in intentions to improve diabetes management relative to standard of care messages. For overall behavioral intention, there were no differences between narrative (*M* = 4.01, *SD* = .61) and standard of care messages (M = 4.06; *SD* = .58); *t*(189) = -.610, *p* = .543.

Behavioral intentions were broken down further to highlight interpersonal communication (H8a), such talking about T1D with others, and action steps (H8b) such as checking blood glucose more often. For interpersonal communication intentions, narrative messages (*M* = 3.66, *SD* = .82) were not significantly different from standard of care messages

(*M* = 3.77, *SD* = .83); *t*(189) = -.926, *p* = .355. Additionally, for action step intentions, there was no significant difference between narrative messages (*M* = 4.28, *SD* = .63) and standard of care messages (*M* = 4.29, *SD* = .62); *t*(189) = -.104, *p* = .917. H8, H8a, and H8b were all not supported (See Table 11).

Exploratory Analyses

Because I saw no main effects of narrative vs. standard of care messages, I next conducted a series of exploratory ANOVAs to examine whether there were any subgroup effects. To do this, I conducted a series of factorial ANOVAs. In each ANOVA, one independent variable was experimental condition and the second independent variable was a measured variable that had the potential to be an effect modifier. The measured variables examined were recruitment location (doctor's office vs. online); gender; current age (12-14 vs. 15-17); age at diagnosis (Median split- below 10 years old vs. 10 or above); years living with T1D (Median split- below 5 years old vs. 5 or above); technology (using both an insulin pump and a CGM vs. not); and HbA1c (controlled vs. uncontrolled, split at <7.5 for controlled and >7.6 for uncontrolled).

On the following outcomes, I found no statistically significant interaction effects: emotion; PME; positive outcome expectations; negative outcome expectations; diabetes acceptance; stress and burnout perceptions; or any level of behavioral intention. I did find a limited set of interaction effects, however, on self-efficacy and transportation (see Table 12).

Self-efficacy was significant based on use of technology (an insulin pump or CGM) in T1D management, *F(*187) = 4.71, *p* = .03. When adolescents used technology in their management, self-efficacy was improved when seeing the narrative messages ($M_{\text{narrative}}$ = 4.01, *SD* = .64; $M_{\text{standard of care}}$ = 3.82, *SD* = .62). Conversely, when not using technology, the standard of care messages were better at improving self-efficacy ($M_{\text{standard of care}}$ = 3.98, *SD* = .80; $M_{\text{narrative}}$ = 3.80, *SD* = .70).

Self-efficacy was also significant based on age of diagnosis; *F(*187) = 4.34, *p* = .04. If diagnosed before the age of 10, narrative messages were better for improving self-efficacy ($M_{\text{narrative}}$ = 4.00, *SD* = .61; $M_{\text{standard of care}}$ = 3.87, *SD* = .75), whereas if diagnosed at age 10 or older, the standard of care messages were better for improving self-efficacy ($M_{\text{standard of care}}$ = 4.03, *SD* = .67; $M_{\text{narrative}}$ = 3.74, *SD* = .77).

Finally, transportation was significant for age of diagnosis; *F(*187) = 6.19, p = .01. For adolescents who were diagnosed before age 10, the narrative messages led to more transportation ($M_{\text{narrative}}$ = 4.12, *SD* = .67; $M_{\text{standard of care}}$ = 3.90, *SD* = .83). For older ages of diagnosis, the standard of care messages had higher levels of transportation ($M_{\text{standard of care}}$ = 4.02, *SD* = .60; $M_{\text{narrative}}$ = 3.74, *SD* = .60).

Discussion

Type 1 diabetes is a lifelong, challenging disease that requires strict, continuous management. Adolescents are a population that has historically struggled to manage T1D due to these arduous demands. Several barriers present a challenge to adolescents' T1D management, particularly self-efficacy, poor outcome expectations, the struggle to accept the disease, and stress and burnout that accompanies management. The present study reflects an effort to gain a better understanding of how narrative messages about challenges to management may impact adolescents with T1D. This study recruited a robust sample of 191 adolescents with T1D – a hard-to-reach population. Through an online experiment, this study tested the effects narrative messages that told stories of college students who grew up with T1D, struggled with a variety of challenges that adolescents typically face, made behavior changes, and ultimately demonstrated how these behavior changes led to positive outcomes and enhanced optimism about the disease. These narratives were tested against didactic standard of care messages that offered more how-to information regarding managing T1D and are currently being used by a top-ranking pediatric endocrinology clinic.

Contrary to study hypotheses, results from this study indicate that narrative messages performed equally as well as standard of care messages in regards to several outcomes including increasing self-efficacy; improving positive outcome expectations and reducing negative outcome expectations; increasing diabetes acceptance; reducing stress and burnout perceptions; and promoting greater behavioral intentions to take the steps to manage their T1D or talk more with significant others about the disease. Despite no significant differences from the standard of care messages, mean scores for narrative messages across most variables scored high, ranging from 3.66 to 4.28 (excluding negative outcome expectations and stress and burnout, as both had a negative valence), indicating that the narrative messages still show promise as a tool for communicating with adolescents about T1D management. These high scores for both the message evaluation and psychosocial outcomes could provide healthcare providers confidence that narrative messages are well received by the target population and may have an effect on improving adolescents' T1D management, in addition to standard of care messages.

Exploratory analysis found an interaction effect for both transportation and self-efficacy, depending on when the adolescent was diagnosed with T1D. If diagnosed before 10 years old, participants reported higher levels of transportation into narrative messages than those who were diagnosed at older ages. Diagnosis after 10 years old led to increased transportation with the standard of care messages. Transportation leads to immersion into a message that can reduce arguments to the message and potentially create affective responses due to identification with the character (Green & Brock, 2000; Mazzocco et al., 2010). In the narrative messages, two of the three characters were diagnosed with T1D at ages 4 and 6, respectively, and the other was diagnosed at 12. It is likely that these young ages of diagnoses resonated with and were personally relevant to the adolescents, which led them to have greater levels of transportation into the narrative messages. For example, a cued recall response from one 17-year-old female who was diagnosed at age 4 said, “I really related to Taylor's story because it was almost exactly like mine.”

Narrative messages were also more effective at boosting self-efficacy if the adolescent was diagnosed before 10 years old; whereas, standard of care messages were better at boosting self-efficacy for adolescents who were older when they were diagnosed. Because two of the three narrative messages included stories of going through childhood and adolescence with T1D, it is reasonable to assume that these messages were greater at improving confidence in adolescents diagnosed younger because it portrayed a realistic and personally relevant story that outlined the barriers of T1D as well as the steps to overcome the barriers. It also may be that adolescents who were diagnosed earlier in life have already heard the standard of care messages, whereas standard of care and informational messages are more helpful to adolescents who were diagnosed when older and have not been given as much of this information.

Importantly, the use of narratives for T1D has been underutilized to date. For example, in the Shen et al. (2015) meta-analysis, none of the 25 studies analyzed looked at T1D. In the de Graaf et al. (2016) systematic review, only two (Gardner, 2010; Luna Nevarez, 2013) of the 153 experimental studies - or 1.3 percent - used narratives for diabetes-related messages; however, both studies focused on type 2 diabetes, which is fundamentally different than T1D. Narrative messages specifically about T1D may provide a novel context for adolescents, especially among those who were diagnosed younger, and this may lead to more positive outcomes. It also appears that adolescents who were diagnosed earlier in life may suffer from message burnout, as standard of care messages have been given to them for many years. This distinction is important to note because messaging efforts intended to bolster self-efficacy may need to be targeted or tailored based on age of diagnosis. Furthermore, narrative messages may be helpful for children with T1D under the age of 10. This study only tested the narrative messages for adolescents, but future research could explore the potential impact of these types of messages on a younger demographic with T1D.

The exploratory analysis also found that narrative messages increased self-efficacy more than standard of care messages, when participants used technology (insulin pump and CGM) for their T1D management. Conversely, participants who did not using technology in their management reported the standard of care messages to be better at improving self-efficacy. This finding is consistent with clinical studies showing that patients who use an insulin pumps and CGMs generally have better glycemic control (Jamiołkowska et al., 2016; Lal & Maahs, 2017). Interestingly, neither sets of narrative nor standard of care messages mentioned what to use for insulin delivery or blood glucose checks. From a clinical perspective, the use of technology has advantages for adherence in adolescents with T1D, due to its accurate measurement (e.g., amount of insulin administered, blood glucose checks, or blood glucose trends) and ease of accessing the information (Gandhi et al., 2015; Guilfoyle, Crimmins, & Hood, 2011). Perhaps future narrative messages could incorporate the use of technology in story development and how technology leads to improved confidence to be able to stay on top their T1D, which may prompt adolescents to adopt the technology and thus increase confidence in their abilities to manage their T1D. Also, this finding suggests that those who use technology found the standard of care messages less impactful, likely because some of the content in those messages may be less relevant to them given their use of technology. This seems to suggest that narratives may be more impactful among adolescents with T1D who use technology to manage their disease.

For message evaluation measures, there were no main effects for emotion, transportation, or perceived message effectiveness (PME). Although not significant, emotion scored higher for narrative messages (*M* = 3.86, *SD* = .92) than standard of care messages (*M* = 3.65, *SD* = 1.04), and this is rather unsurprising given that each narrative message ended with a positive outlook based on the behavioral changes made by the characters, whereas the standard of care messages were more informational and highlighted the clinical importance of managing T1D. This speaks to an important element of narrative messages that may be different than standard of care – that is, the ability to inspire and motivate. While standard of care messages may be a better tool for straightforward information about *how* to manage, narratives are likely better at providing adolescents with reasons for *why* to better manage their T1D, and to provide inspiration and hope in that regard. Emotion, coupled with a positive and optimistic outlook, may be important for volitional behavior, and the narrative messages could help facilitate this in ways that standard of care messages may not.

Additionally, Nabi and Myrick (2018) note that hope is an intriguing and potentially effective tool for message development. The narrative messages in this study attempted to evoke hope and positive emotions by providing a resolution to the barriers that adolescents face. In the specific context of fear appeals in messages, Nabi (2015) further explains that following threatening information in messages with information appealing to self-efficacy may generate hope. While the narrative messages did not specifically target fear, some of the consequences to poor management (e.g., frequent hospitalizations) could have been perceived as threatening information; however, after these negative outcomes were explained, the character detailed how he or she alleviated these concerns. Nabi (2015) also states that telling people what to do, as well as how they can do it may increase hope and motivation. The narrative messages outlined the hope and motivation. The cued recall portions of the narrative messages also point to the idea that the narratives provided optimism for T1D management. For example, sample cued recall responses said “Having well-managed diabetes will make you feel accomplished and better about yourself” and “Having a good control of this disease would not prevent me from doing activities that I like.” It is possible that both message types scored high on emotion, self-efficacy, and stress and burnout perceptions because these outcomes were being targeted from multiple directions. The narrative messages offered hope that the adolescents can overcome their barriers, whereas the standard of care messages told adolescents what to do to best manage their T1D.

What was surprising among the message evaluation outcomes was that there was no difference for transportation among the two message types. Past narrative literature strongly suggests that narratives will lead to more transportation, given the personal relevance and shared experiences by the audience (Green & Brock, 2000; Hinyard & Kreuter, 2007). Adolescence marks a time of identity formation, and adolescents may integrate T1D into their identity and sense of self (Oris et al., 2016; Silverstein et al., 2005). Because participants in the study were equally transported into the standard of care and narrative messages, it is highly plausible that any message about T1D will lead to transportation into the message because the disease is part of their identity – i.e., any message about T1D management may be viewed as personally relevant to them and processed centrally as the Elaboration Likelihood Model would suggest (Petty & Cacioppo, 1986).

Additionally, T1D is a unique chronic illness in which the adolescent is essentially required to perform his or her disease management. While adolescents with T1D see their healthcare providers approximately three or four times per year, most day-to-day management is autonomous. This increasingly becomes more difficult for adolescents as they gain independence from their parents. When the disease is not fully accepted as part of their identity, adolescents may not be motivated to adhere to treatment (Oris et al., 2016). This would explain why diabetes acceptance ($M_{\text{narrative}} = 4.03$; $M_{\text{standard of care}} = 4.16$) and action-based behavioral intentions ($M_{\text{narrative}} = 4.28$; $M_{\text{standard of care}} = 4.29$) were high for both conditions. Future studies are needed to more deeply understand how management messages intersect with identity and identity formation among adolescents with T1D.

This study shows that there may be multiple ways to get to an effective message across to help adolescents with T1D. Narrative messages may serve more as a motivational and inspiring message which tell adolescents that they *can* overcome barriers and manage their T1D, while standard of care may still provide some necessary didactic information that tells adolescents what they *need* to do and *how* to do it, especially for adolescents who most need that information (e.g., those who do not use technology to manage their disease). In other words, given that narratives did not outperform the standard of care messages, but that also the reverse of this was not the case, one interpretation is that both messages types provide something valuable to adolescents with T1D. This argument is supported by the fact that both message types scored relatively highly on most outcomes. Thus, one possible avenue in which to get the best from both types of messages is to combine elements from both into narratives, and integrate standard health tips on how to manage into the character's story. For example, one of the standard of care messages used an analogy of how managing T1D is like taking care of a car. This message actually proved to be quite memorable for the standard of care treatment, with almost a third of the participants (*n* = 33; 34%) mentioning a car in their cued recall. One sample response was, "Being a diabetic [is] just like driving a car and you need to monitor the signals given." In the narrative message, the consequences of poor management such as hospitalization or loss of a driver's license are outlined, as well as a small section of what the character did to overcome these issues. The didactic information of the standard of care messages could be placed in the middle of a narrative between the consequences and the positive outcome. There are ways that the best elements of standard of care messages could be integrated into narrative messages to most effectively help adolescents with T1D. Or, another approach would be print materials or videos that contain discrete segments with both types of information – e.g., a doctor or peer talking about how they best manage their T1D, followed by a segment of an adolescent or young adult telling their T1D management story. Future research is needed to look at the best way to design messages that integrate the best of both narrative and standard of care messages.

A study by Mulvaney et al. (2012) showed that adolescents who receive messages about T1D may not immediately improve their glycemic control; however, having no message actually made them worse. Essentially, messages about T1D have the potential to halt adolescents' poor management. It may not depend entirely on a particular message. Any type of communication can be helpful – and well-received – by adolescents. This is further supported by other interventions that have also shown that messages about T1D management are well-received and favorable for adolescents (Franklin et al., 2006; Mulvaney et al., 2011b; Mulvaney et al., 2012; Rami et al., 2006). Additionally, recommendations for efforts with adolescents with T1D encourage focusing on helping them cope with and problem solve negative emotions and barriers that accompany the disease (Grey et al., 2000; Fisher et al., 2007). This was a primary factor in the narrative messages created for this study. The narrative messages aimed to encourage adolescents with T1D overcome negative emotions and barriers to their management by providing items to address these issues, such as increased blood glucose checks, improved communication with their healthcare team, and teaching friends about the importance of their T1D management. While standard of care messages about the importance of managing T1D will likely always be present in clinical practice, narrative messages can provide a unique opportunity to bring fresh perspectives about living with and managing the disease.

There were also additional data from the recall responses after adolescents viewed the sets of messages that provide promising insights into how adolescents responded to the messages, and additional support for the narratives. Responding to the narratives, one participant wrote, "'Being in control of your diabetes is also being in control of your life,' I really never thought about it in that way." This speaks to the idea of diabetes acceptance, self-efficacy, and positive outcomes, where the adolescent felt that they were now in control of their life, rather than T1D being in control. Additionally, because managing T1D in public may lead to social judgments, another narrative participant wrote, "Checking sugar in public is a good thing," which highlights one of the key elements of Michael's story about not being ashamed of T1D and that it is important to check blood glucose no matter where you are. Furthermore, adolescents who viewed narrative messages were able to see the positive outcomes that proper management can have on their lives. Select responses included, "Having a good control of this disease would not prevent me from doing activities that I like;" "They were all able to get over the road block that was in the way of [their] management;" and "Checking your sugar and controlling your carbs will help keep you from being frequently hospitalized and will allow you to live a happier life."

Cued recall responses from the narrative messages also spoke to the fact that these messages were personally relevant to the adolescents and highlighted that they are no different than other teens without the disease. Sample responses include, “They [were] diagnosed quite late just like me. It was interesting seeing a similar perspective;” “Kids with diabetes can be just like everyone else [but] we still have to check our blood sugars;” and “I am not alone with how I feel about diabetes.”

At at the end of the study, there was an optional open-ended response section which allowed the participants to voice any additional thoughts about the message. While not every participant completed this portion, those who did emphasized the struggles they face in their T1D management and spoke to how the narrative messages were impact for them. A response from a 17-year-old female who was diagnosed when she was 4 years old said, “I am the only person at my school who is a type 1 diabetic … it makes it hard because no one else is living with it too.” Another response from a 16-year-old male who was diagnosed two years prior stated, “It is just nice to know that you are at college with type 1. I don't know if I can leave home yet with my highs and lows.”

Perhaps more telling to why narrative messages may be an important complement to standard of care messages were the additional thoughts from participants who viewed the standard of care messages. One 14-year-old female who was diagnosed at 9 explained, “I don't feel like the three messages have enough appeal to emotion because they did not make me feel any certain way when I read them … I think there needs to be more emotion and feeling in the messages, maybe show the struggles people went through and how it was hard to overcome but eventually, they did.” This is exactly what the narrative messages in this study attempted to do. Additionally, another 14-year-old female who was diagnosed at 11 said, “I think sports and their influence on diabetes is pretty important if there needed to be more added." Taylor's story detailed sports, and this could suggest that standard of care messages may be too general to fully target what adolescents care about.

Limitations and Future Directions for Research

There were several limitations to this study. Recruitment of participants was both a challenge and limitation to this study. To reach sufficient sample size to power the experiment, *N* = 200 participants were needed. Recruitment from pediatric endocrinology unit at the University of North Carolina Children's Hospital only yielded 45 (24%) of the overall sample. There were additional efforts to recruit from other pediatric endocrinology clinics within the Triangle Region of North Carolina; however, these efforts were not feasible due to IRB constraints at the different institutions. Thus, online recruitment efforts through Facebook, forums, and a panel from Qualtrics were used to recruit the remaining participants. This approach garnered several low-quality responses that were not included in the final analysis, with 53 responses from Qualtrics and four responses from Facebook that were excluded. The relatively high rate of bad cases from the online sources is thought to be due, at least in part, to the increase in bots and other automated programs that seek to mimic human responses in order to quickly receive incentives across several surveys (Teitcher, Bockting, Bauermeister, Hoefer, Miner, & Klitzman, 2015). Additionally, participants taking the study at home may not have paid full attention to messages, while participants at the endocrinology clinic may have been primed to think more positively about their T1D management because they were at their doctor's appointment.

The data in this study are cross-sectional, and participants were exposed to messages just once. A more extended study of narrative messages compared to standard of care messages is needed to determine the potential long-term changes that messaging efforts can have on adolescents with T1D. Because T1D is a lifelong disease and adolescents will always have to perform management behaviors, future research should look at the effects over time in a longitudinal study.

Both narrative and standard of care messages were evaluated highly and scored well across most outcome variables. However, because there was not a no-treatment control incorporated into the experimental design, it is unknown how much better both sets of messages would operate compared to no messages. However, as past interventions with messages for adolescents with T1D have shown, participants who do not receive any messages typically worsen in their glycemic control compared to the treatment condition (Mulvaney et al., 2012). Future studies should include a no-treatment control to determine the effectiveness of narrative and standard of care messages compared to no message.

Participants were also exposed to the messages in a controlled setting, where they had to view each for at least 30 seconds. Standard of care messages may have been just as effective as the narrative messages because participants actually read them. Narrative messages may be more effective in a more natural setting because adolescents may be more likely to actually read and remember them. More research is needed to understand the settings in which narrative messages work best.

Additionally, the messages in this experiment were not matched on length, content, or specific goals (other than the importance of checking blood glucose), so the two conditions were not a matched comparison. The narratives in this study were an average of 450 words, whereas the standard of care messages averaged 168 words. Although the messages were not identical in structure or content, Niederdeppe et al. (2011) suggested that more ecologically valid studies should compare narrative messages to things that closely resemble what is commonly offered by healthcare providers. The standard of care messages in this study were taken directly from materials used by a highly ranked pediatric endocrinology clinic and given to adolescents with T1D, increasing the ecological validity of this study.

To this point, the standard of care messages selected in this study were developed by trained endocrinologists and CDEs, thus these messages were designed entirely to promote behavior change for adolescents with T1D. These messages also followed clinical recommendations for educating adolescents with T1D management (Knowles et al. 2006). The endocrinologist who helped with recruitment for this study stated, “Our clinic does more to train and educate our patients than what an average pediatric endocrinology clinic does.” Furthermore, the materials adapted from a pediatric endocrinology clinic were from a top-ranked hospital, and the level of care provided to adolescents with T1D could be considered exceptional and not a true “standard of care.” An environmental scan of current materials would help inform true standard of care messages and establish future comparisons.

Conclusion

Adolescents with T1D face many barriers, but communication and messaging efforts may provide an outlet to reduce these challenges and offer avenues for hope and optimism about their disease management. This study worked with a hard-to-reach population to test and evaluate sets of messages that can be effective in adolescents’ T1D management. Although not proven to be significantly better than standard of care messages, narrative messages scored well, and this type of message remains an intriguing area for adolescents with T1D. Narrative messages may provide important, inspiring role model stories that can help adolescents manage their T1D. Conversely, standard of care messages – which were also evaluated highly and scored well – may provide the necessary didactic information that emphasizes the steps to take to manage this complex disease and goals for self-management. Overall, results from this study imply that narratives and standard of care messages could work in complementary ways to help adolescents with T1D. Pediatric endocrinology clinics and other public health institutions that work with adolescents with T1D could start incorporating narrative messages into their practice as a complement to standard of care messages.

APPENDIX A. Narrative Interview Guide for College Students with T1D

1. Ask the participant a general question about a topic

- Tell me about when you were diagnosed with diabetes.
    - How old were you?
    - What were your first thoughts?
- Tell me how you went about managing your diabetes when you were younger.
    - How many times did you check your blood sugar?
    - What did you find easiest about managing diabetes?
    - What were your initial concerns?
    - Did you get over these concerns?
        - If so, how?
- Tell me how you go about managing your diabetes now?
    - How many times do you currently check?
        - How confident are you that you can check your blood sugar in various situations?
    - How has your management changed as you've grown up?
        - Any new challenges?
    - What has worked best for you?

2. Ask the participant to elaborate on parts of their story

- *Outcome expectations*
    - Do you feel as if your diabetes keeps you from doing things with your friends? If so, how?
    - Do you think it keeps you from living my life the way you want? What are some examples of this?
    - What types of responsibility come with diabetes management, and how do you handle these responsibilities?
    - What have you done to make sure you have fewer low or high blood sugars?
    - Would you say having good management helps you avoid conflict with your parents/guardians?
    - In general, does your management make you feel good about yourself? Why or why not?
- *Self-efficacy*
    - How confident do you talking to your doctor or nurse about any problems you're having with taking care of your diabetes?
        - When would you go and seek additional help?
    - Are there times when management becomes more difficult? If so, when, where, and why?
    - Are you even overwhelmed by managing your diabetes?
        - How do you overcome this?
- *Social support*
    - How have your parents helped you with your management?
        - At what point did you feel comfortable taking more responsibilities toward your management?
        - Do you still talk about your diabetes with your parents?

- Have you met any other people your age with diabetes?
    - How was this helped your management?
- Have you joined any diabetes support groups?
    - If yes, what types?
    - If yes, how’s it helped?
    - If no, why not?

APPENDIX B. Pretest PME Questionnaire for Adolescents with T1D

You will now be asked about how the message you just read affects your thoughts toward your overall type 1 diabetes management.

For the following items, please indicate how much you agree with the statement, with 1 being “strongly disagree” and 5 being “strongly agree.”

1. This story makes me think about improving my diabetes management.

Strongly disagree 1 2 3 4 5 Strongly agree

2. This story gives me good reasons to get better control over my type 1 diabetes management.

Strongly disagree 1 2 3 4 5 Strongly agree

3. This story gives me the confidence to have better control over my type 1 diabetes management.

Strongly disagree 1 2 3 4 5 Strongly agree

4. This story motivates me to have better control over my type 1 diabetes management.

Strongly disagree 1 2 3 4 5 Strongly agree

5. This story makes me think about checking my blood sugar more often.

Strongly disagree 1 2 3 4 5 Strongly agree

6. This story gives me good reasons to check my blood sugar more often.

Strongly disagree 1 2 3 4 5 Strongly agree

7. This story gives me the confidence to check my blood sugar more often.

Strongly disagree 1 2 3 4 5 Strongly agree

8. Reading this story motivates me to check my blood sugar more often.

Strongly disagree 1 2 3 4 5 Strongly agree

APPENDIX C. Pretest Interview Guide for Adolescents with T1D

I would like to thank you speaking with me today to learn about diabetes management messages and how these messages might impact your thinking and behavior toward managing your diabetes. Your feedback is important, and I'd like to hear your thoughts about the messages you will be shown. Our discussion will approximately take about 30 minutes. Your participation is voluntary and you do not have to answer any questions that you do not want to answer; however, I encourage you to participate in the discussion as often as possible.

I am going to record this session so we can make sure we do not miss anything that is said. All responses will be confidential and no one other than those present and our client will know who said what. Please make sure you speak up so that we can have accurate remarks and to make sure we do not miss anything.

If you have any questions or concerns about this project, you can contact Dr. Seth Noar at noar@email.unc.edu.

First, do you have any questions before we get started?

---

1. What did you think about the story?

2. What do you think this story is trying to tell you?
   a. What did you think was the conflict in this story?
   b. What was the resolution to the conflict?

3. Was there anything in the story that was effective at getting you to better manage your type 1 diabetes? If so, what?
   a. At what stage in your life with type 1 diabetes do you think this would've been most helpful?

4. How could the story be improved?

5. Are there any words/phrases to clarify? Are there any parts of this your friends or someone else with diabetes wouldn't understand? **(circle parts that are confusing, highlight parts that are good, cross out parts that are bad or boring)**

6. Where do you think this message would be best placed?
   a. Instagram
   b. Web
   c. Brochure
   d. Poster

APPENDIX D. Narrative messages

VANESSA'S STORY

Hi, my name is Vanessa. I'm a 22-year-old college student, and I have type 1 diabetes. This is my story.

I was diagnosed with type 1 diabetes when I was 6 years old, so I've pretty much known diabetes my whole life. Initially, **my parents and school nurses handled my management, but I took control when I started middle school.** It was challenging to make sure I was checking my blood sugar without being reminded, counting carbohydrates correctly, and giving myself the right amount of insulin. Of course, I could still rely on my parents if needed, but they thought it was best for me to start being more responsible for my management. **After all, it's my body and my future.**

At first I was on top of things, but then as I became more independent, I stopped checking as much as I should have. **None of my friends had diabetes, and at the time, it just seemed better to kind of ignore it.** I also fell into a bad habit of just snacking and guessing what my blood sugar was and how much insulin I needed or not even taking insulin at all. It won't come as a surprise that I struggled with frequent high blood sugars. Because I wasn't on top of my management, I was actually hospitalized three times with diabetic ketoacidosis! **I remember how scary it was and how sick my body felt.** What made matters even worse is my diabetes made me stressed, which made my blood sugar even higher, and that made me even more stressed. It was a vicious cycle that I couldn't seem to escape from.

After my last hospitalization, **I knew that I needed to make a change.** I started to check my blood sugar more frequently so I could see if I was going too high. Knowing what my blood sugar was allowed me to stay in control and avoid dangerous complications. I remember thinking when I was younger that I could do whatever and wanted, and I'd be fine. I was wrong, and I should've taken better responsibility for my management.

It's been a few years since my last trip to the hospital because of my diabetes, and I couldn't be happier. I'm more careful about carb counting and how much insulin I'm giving myself, as well as checking my blood sugar more often. Knowing what my blood sugars are helps with my diabetes management. I feel so much better about myself and less stressed about my diabetes than ever before. **I now know that being in control of my diabetes means being in control of my life, and it feels great.**

TAYLOR’S STORY

Hi, my name is Taylor. I’m a 21-year-old college student, and I have type 1 diabetes. This is my story.

I’ve had type 1 diabetes for practically my entire life. I was diagnosed when I was 4, so I often tell people that maybe this is good because I’ve never really experienced life without diabetes. **Growing up, I felt like I was like other kids my age for the most part.** I just had to check my blood sugar and scrape the icing off birthday cake at parties. My parents did their best to make diabetes a part of my life, and I guess I was okay with that.

It wasn’t until I became a teenager that I started taking control of my own management, and I found myself hating diabetes. By that point, I had the disease for so long and knew what I was supposed to do. **I knew I was supposed to check my blood sugar frequently, take insulin, and count carbohydrates, but I chose not to take care of myself as well as I should.** Because of this, I became less aware of high blood sugars. I remember playing soccer when my blood sugar was 350, and I couldn’t even tell. I didn’t realize how much I could have been damaging my body.

At that time, I knew my blood sugars weren’t good, and I felt guilty about it, but I developed this idea that no matter what I did, I couldn’t control my diabetes. I couldn’t be successful at management. However, **I could be successful at other things in my life.** I knew I could be a great athlete and a great student, so I started to put more importance on that side of my life, and I let diabetes fall behind.

And then everything changed. When the doctor told me that I was putting myself at risk of losing my vision and potentially my driver’s license, that was it. I decided to give myself a fresh start. I no longer accepted a blood sugar of 300. I didn’t want to be okay with that number, so I made the effort to be more optimistic and confident in my ability to manage my diabetes. **I talked more with my doctors and started checking my blood sugar more to catch highs before they happened.** I’ve noticed that since I’ve changed, I can do things better than before. I feel better when I’m working out, and I can focus better when I’m trying to study. When I was younger, I thought I was doing all those things just fine with bad control, but now that I have better control, I see that back then it wasn’t fine at all, and I can do those things when I was younger.

MICHAEL'S STORY

Hi, my name is Michael. I'm a 20-year-old college student, and I have type 1 diabetes. This is my story.

"Oh, it's probably just the flu," is what my parents thought right before I was diagnosed with type 1 diabetes. As a 12-year-old, I knew nothing about diabetes, and neither did my family. It was a hard transition from being a kid who could eat and do whatever he wanted to now being told to stop what I'm doing and make sure I check my blood sugar. **While this was a shock to the system, I was confident in my ability to manage my diabetes.** When I was initially diagnosed, I told myself that I would be on top of my diabetes, I would check multiple times per day, and that I wouldn't let my diabetes control me. However, the constant highs became problematic. I quickly fell into a rut and it was hard to maintain the balance of when I could just be me, and not me with diabetes.

I remember that I convinced myself to not worry about my diabetes because I didn't want to be secluded because of it. I thought, "Well, if it's high, then there's nothing I can really do. Why should I be any different?" **I would feel self-conscious pulling out my meter in class because I didn't want people to see that I was checking my blood sugar.** I began checking a lot less than I should have. But my blood sugars became worse and I was less aware of what was going on with my body, and this poor management of my diabetes was holding me back from being a normal teenager.

It wasn't until sophomore year of high school that I regained the confidence to take full control of my diabetes. I thought, "Hey, it's really important for me check often, no matter what anyone else thinks." Now when I check my blood sugar in public, I feel good about myself because I am taking a more active approach to managing. **And, if anything, I took this as an opportunity to teach people about diabetes.** I would explain what my blood sugars meant and how it affected my body.

Over time I realized that people were impressed that I was taking my diabetes seriously. This positive reinforcement showed that diabetes management matters, not only to me but also to people around me. Whether it was checking more often, counting carbohydrates correctly, talking more with my doctors, or taking immediate action when my blood sugars were out of range, **I found that having a proactive approach toward management made me feel better not only about my diabetes, but also about my life.**

APPENDIX E. Standard of Care Messages

TYPE 1 DIABETES

Over 130,000 people under the age of 18 have type 1 diabetes.

The choices a person with diabetes make will have an impact on their blood sugar levels each day. Taking care of diabetes means they will need to make healthy food choices, be physically active, monitor blood sugar, and take medications. All people with type 1 diabetes need insulin.

The goal of taking care of diabetes is to feel well today, to keep doing the things that are enjoyable, and to avoid complications in the future.

There are multiple goals of treatment. Short-term goals include keeping blood sugars as close to the 80-180 range as possible and avoiding extreme low or high blood sugars. Long-term goals include working with doctors about blood sugar goals, keeping healthy, and avoiding long-term complications from high blood sugars.

TYPE 1 DIABETES

Managing diabetes is like taking care of a car.

If a person drives a car, they use the gauges & meters to help drive every day. When driving, a person looks at the instrument panel to tell them what the next step should be. To know how fast they are going, the person driving looks at the numbers on the speedometer. If a person sees that they are going above the speed limit, they step on the brake. If they are going too slow, they step on the accelerator. To know their fuel levels, they look at the gas gauge. If the gas level is low, they stop at the gas station and refuel. If they see the engine light come on, they know something needs attention and will probably call a mechanic. If a person drives your car without a speedometer, gas gauge, or engine light, sooner or later they would either get a ticket for speeding, would run out of gas, or the car would breakdown.

A person trying to manage type 1 diabetes without monitoring blood sugar levels is like driving a car without these instruments. A person with diabetes may be able to go along OK for a while. But sooner or later, the lack of information, and not taking corrective action, would probably cause serious health problems.

TYPE 1 DIABETES

There are multiple reasons to check your blood sugar.

Why does a person with type 1 diabetes need to check their blood sugar? Checking blood sugar can help a person with diabetes reach target management goals. Keeping blood sugar near normal most of the time helps lower the chance of complications. It helps a person know how much insulin to take, and it helps to know whether they need a snack before an activity or before bed. It can also help a person learn how food, activity, and exercise affect blood sugar. Finally, checking blood sugar can help a person with diabetes and their doctor know whether any changes are needed in their medications.

When does a person with diabetes need to check their blood sugar? A person with diabetes should check before meals and at bedtime, if they feel like their blood sugar is too low or too high, and when they need extra information about their diabetes, such as during exercise or sickness. If you feel like your blood sugar is low or high. A person's doctor can also identify times in which a person with diabetes needs to check their blood sugar.

APPENDIX F. Experimental Design & Survey Instrument

Construct	Item	Response Scale	Source
Parental consent			
Youth assent			
Demographics			
Gender	What is your biological sex?	1 = Male 2 = Female	
Age	How old are you?	[answers range from 12 to 17]	
Age of diagnosis	How old were you when you were diagnosed with type 1 diabetes?	[answers range from less than a year old to 17]	
Ethnicity	Are you Hispanic or Latino/a?	0 = No 1 = Yes	
Race	What is your race or ethnic identity?	1 = White/Caucasian 2 = Black/African American 3 = Asian/Pacific Islander 4 = American Indian/Native American 5 = Other (please specify) [Check all that apply]	
Socioeconomic Status	If you bought a full school lunch tomorrow, what would you pay? Even if you never buy a school lunch, think about what you would pay.	[answers range from 0-I do not test my blood sugar to 15 or more times]	
T1D-specific information			
Blood glucose testing	On average, how many times do you check your blood sugar or look at your Continuous	[Open ended]	

		Glucose Monitor (CGM) per day?		
	Insulin delivery method	Are you currently using an insulin pump?	1 = Yes [pump] 2 = No [shots/pen]	
	Continuous Glucose Monitor	Do you use a continuous glucose monitor (CGM)?	1 = Yes 2 = No	
	HbA1c	What was your most recent HbA1c number? If you don't know, please leave it blank.	[Open ended]	
	Diabetes information	How often do you typically receive information about type 1 diabetes from the following sources? 1. Parent/guardian 2. Doctor 3. School nurse 4. Friends 5. Diabetes websites 6. Social media (Facebook, Instagram, Snapchat, Twitter) 7. Other people with type 1 diabetes 8. Diabetes organizations like the JDRF or American Diabetes Association	1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Very often	
Message exposure (randomized) – 30 seconds before being allowed to advance				

	Narrative condition	1. Vanessa’s story 2. Taylor’s story 3. Michael’s story	Message order randomized	
	Standard of care condition	1. Reasons to check 2. Car analogy 3. Goals of managing T1D	Message order randomized	
Cued recall				
	Cued recall	Based on what you just read, what were three things that stood out to you from the messages?	[3 open-ended response options]	
Message evaluation				
	Message source preference	If these messages were given out to people with type 1 diabetes, where would you like to see them?	1 = Doctor’s office 2 = School nurse’s office 3 = On diabetes websites 4 = On social media (Facebook, Instagram, Snapchat, Twitter) 5 = Diabetes organizations like the JDRF or American Diabetes Association 6 = Other [text entry] [Check all that apply]	
	Emotion - hopefulness	The set of messages I just read made me feel… 1. Hopeful 2. Optimistic 3. Encouraged	1 = Not at all 2 = A little 3 = Somewhat 4 = Very 5 = Extremely	Nabi & Myrick (2018)
	Transportation	Please answer how much you agree with each statement about the set of messages you just read, ranging from strongly disagree to strongly agree.	1 = Strongly disagree 2 = Disagree 3 = Neither agree or disagree	Appel et al. (2015)

		1. I could picture myself in the scene of the events described in the messages. 2. I was mentally involved in the messages while reading them. 3. I wanted to learn how the messages ended. 4. The messages affected me emotionally. 5. While reading the messages I had vivid images of the people involved.	4 = Agree 5 = Strongly agree	
	Perceived Message Evaluation (PME)	The set of messages I just read… 1. Made me think about improving my diabetes management. 2. Gave me good reasons to get better control over my diabetes management. 3. Gave me the confidence to have better control over my diabetes management. 4. Motivated me to get better control over my diabetes management. 5. Encourage me to talk to someone about my diabetes management	1 = Strongly disagree 2 = Disagree 3 = Neither agree or disagree 4 = Agree 5 = Strongly agree	Noar et al. (2018)

	Wishful identification (narrative condition only)	1. The people in the messages are the sorts of people I want to be like. 2. I wish I could be more like the people in the messages. 3. I would like to do the kinds of things the people in the messages do.	1 = Strongly disagree 2 = Disagree 3 = Neither agree or disagree 4 = Agree 5 = Strongly agree	Hoffner & Buchanan (2005)
Psychosocial outcomes				
	Self-efficacy	I am confident that I can… 1. Talk to my doctor any problems with my diabetes. 2. Check my blood sugar even when I'm really busy. 3. Manage my diabetes the way my doctor wants me to. 4. Manage my diabetes even when I'm overwhelmed. 5. Realize things that can make it hard to manage my diabetes. 6. Find ways to deal with feeling frustrated by my diabetes.	1 = Strongly disagree 2 = Disagree 3 = Neither agree or disagree 4 = Agree 5 = Strongly agree	Iannotti et al. (2006)
	Outcome Expectations	If I were to take care of my diabetes like I'm supposed to, I would... **Negative (reverse-scored)** 1. Think too much about	1 = Strongly disagree 2 = Disagree 3 = Neither agree or disagree	Iannotti et al. (2006)

		my diabetes. 2. Not be able to do things with my friends. 3. Not be able to live my life the way I want to. 4. Be on too strict of a schedule. 5. Be overwhelmed. **Positive** 1. Have fewer high blood sugars. 2. Be able to talk to my friends about my diabetes. 3. Avoid fighting with my parents/guardians about my diabetes. 4. Talk more with my doctor about my diabetes. 5. Be in better control of my diabetes. 6. Feel good about myself. 7. Be healthy.	4 = Agree 5 = Strongly agree	
	Diabetes Acceptance	Think about how you live with type 1 diabetes, and answer the questions below. 1. I have fully accepted having diabetes	1 = Strongly disagree 2 = Disagree 3 = Neither agree or disagree	Schmitt et al. (2018)

		2. Diabetes is a normal part of my life 3. Diabetes is part of me 4. Diabetes makes me sad [reverse-scored]	4 = Agree 5 = Strongly agree	
	Stress and burnout perceptions	Living with diabetes makes me feel… 1. Angry or frustrated. 2. Stressed, anxious, or overwhelmed. 3. Unmotivated to do things to fix my diabetes.	1 = Strongly disagree 2 = Disagree 3 = Neither agree or disagree 4 = Agree 5 = Strongly agree	Mulvaney et al. (2011a)
	Behavioral Intentions	Over the next 3 months, I plan to... **Interpersonal** 1. Talk to my friends about my diabetes. 2. Talk to my doctor about how I can better control my diabetes. 3. Talk with my parents about ways I can better control my diabetes by myself. **Action** 1. Check my blood sugar (or look at my CGM) at least 5 times per day. 2. Get better control over	1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Very often	Ajzen & Fishbein (1980, 2005)

		my diabetes. 3. Give myself insulin if my blood sugars are higher than what they should be. 4. Check my blood sugar (or look at my CGM) when I'm not feeling normal.		
Additional thoughts				
	Additional thoughts	If there was anything you'd like to add about the messages or about the study, please indicate it below.	[open ended]	
Redirect to incentive portal (excluding Qualtrics panel)				
Study complete				

Figure 1. Formative research activities for message development

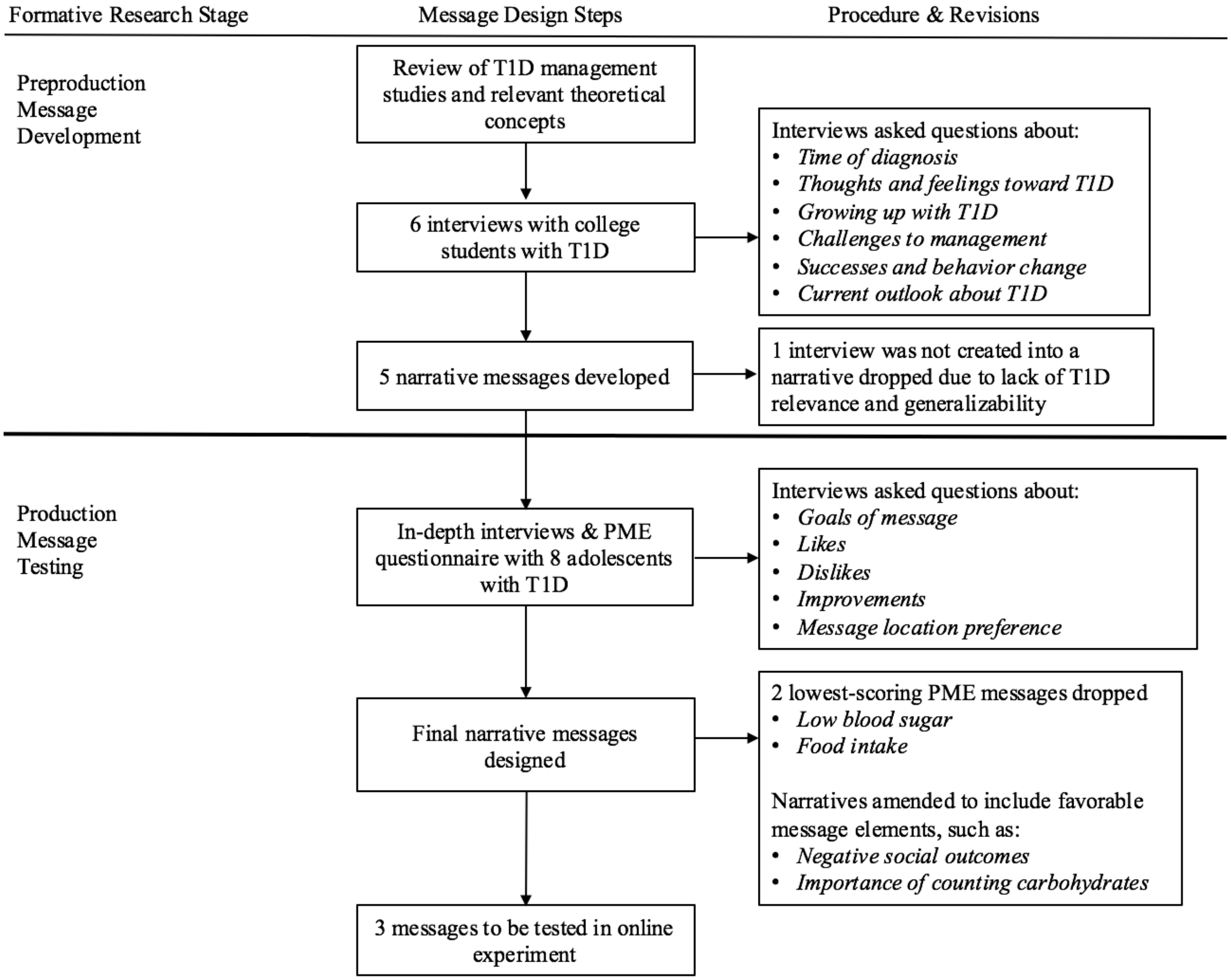

Figure 2. Conceptual model

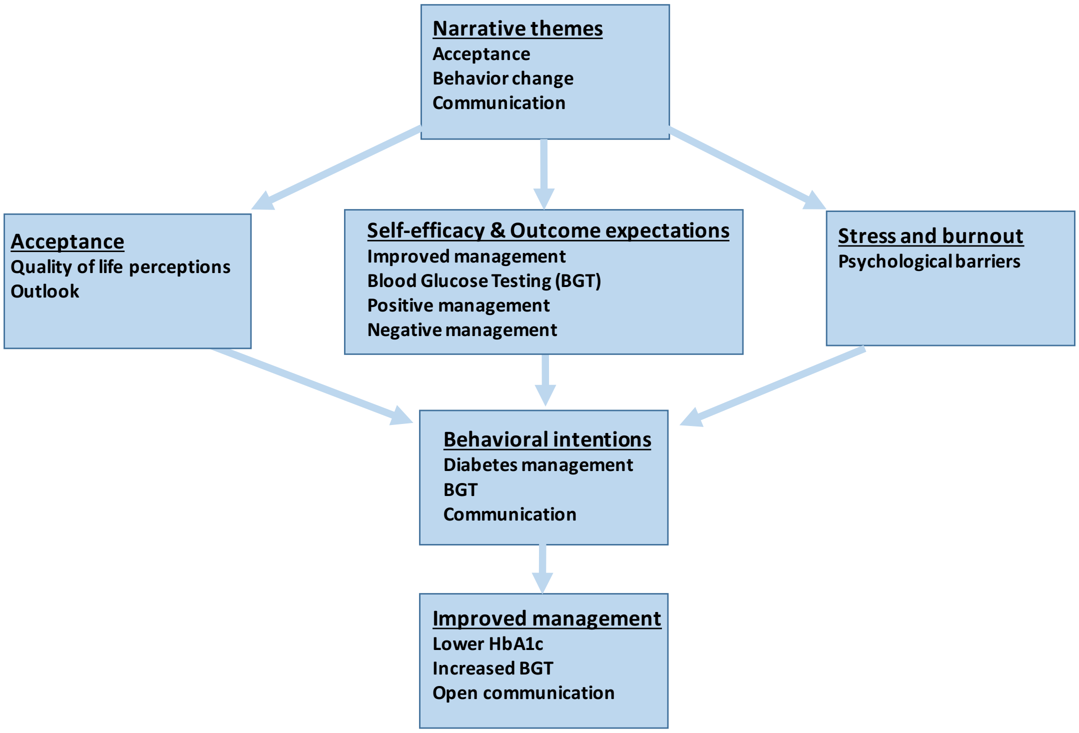

Table 1. Sample messages from the pretest narratives

T1D conflict	Sample Message from Narrative
Burnout	It wasn't until I became a teenager that I started taking control of my own management, and I found myself hating diabetes. By that point, I had the disease for so long, I knew what I was supposed to do. I knew I was supposed to check my blood sugar frequently, take insulin, and count carbohydrates, but I chose not to take care of myself as well as I should. Because of this, I became less aware of high blood sugars. I remember running a cross country race when my blood sugar was 350, and I couldn't even tell. I didn't realize how much I could have been damaging my body.
Negative outcome expectations	I started getting into this bad habit of choosing <u>not</u> to do it. I really didn't like being different than my friends and having to stop doing whatever I was doing because of my diabetes. After a while, I noticed my blood sugars getting worse, but that didn't seem to matter to me. I was more focused on being just like my friends. But, as I got older, I started seeing the negative impact of poor control. Since I wasn't taking my management seriously, my A1c was too high and my blood sugars were unpredictable. So… my doctor wouldn't let me get my driver's license because she thought it was too dangerous.

Social stigma	I remember that I convinced myself to not worry about my diabetes because I didn't want to be secluded because of it. I thought, "Well, if it's high, then there's nothing I can really do. Why should I be any different?" I would feel self-conscious pulling out my meter in class and checking because I didn't want people to see that I was checking my blood sugar. I began checking a lot less than I should have. But my blood sugars became more erratic and I became less aware of what was going on with my body, and this poor management of my diabetes was holding me back from being a normal teenager.
Low blood sugar	I was on the basketball team, and I thought being an athlete was more important than managing my blood sugar correctly. I would push through low blood sugars during practice because I didn't want to let my coach or teammates down, and I didn't want it to look like diabetes was holding me back. I would see a blood sugar of 41, and think, "Wow, that's pretty low, but I'll be alright." I thought I was invincible, but I didn't realize how much danger I was actually putting myself in.
High blood sugar and hospitalization	I also fell into a bad habit of just snacking and guessing what my blood sugar was and how much insulin I needed. It won't come as a surprise that I struggled with frequent high blood sugars. Because I wasn't on top of my management, I was actually hospitalized three times with diabetic ketoacidosis! I remember how scary it was and how sick my body felt. What made matters even worse is my diabetes management made me stressed, which made my blood sugar even higher, and that made me even more stressed. It was a vicious cycle that I couldn't seem to escape from.

Table 2. Participant demographics by study condition

	Narrative condition *n* = 94 *n* (%) or *M* (SD)	Standard of Care condition *n* = 97 *n* (%) or *M* (SD)	Total *n* = 191 *n* (%) or *M* (SD)
Gender			
Female	49 (52%)	48 (49%)	97 (51%)
Male	45 (48%)	49 (51%)	94 (49%)
Age, mean years (SD) [age range 12-17]	14.66 (1.59)	14.58 (1.51)	14.62 (1.55)
Race			
White	66 (70%)	66 (70%)	132 (69%)
Black or African American	11 (13%)	19 (19%)	30 (15%)
Asian or Pacific Islander	4 (4%)	4 (4%)	8 (4%)
More than one race	9 (9%)	7 (6%)	16 (9%)
Other/did not answer	4 (4%)	1 (1%)	5 (3%)
Hispanic	18 (19%)	9 (9%)	27 (14%)

Note. M=Mean; *SD*=standard deviation; *n*=sample size

Table 3. Participants' T1D-specific information by study condition

	Narrative condition *n* = 94 *n* (%) or *M* (SD)	Standard of Care condition *n* = 97 *n* (%) or *M* (SD)	Total *n* = 191 *n* (%) or *M* (SD)
Age when diagnosed	8.67 (4.16)	9.31 (3.66)	8.99 (3.92)
Length of time with T1D	6.03 (4.28)	5.26 (3.57)	5.64 (3.94)
Insulin delivery method			
Pump	54 (57%)	55 (57%)	109 (57%)
Multiple Dose Injections (MDI)	40 (43%)	42 (43%)	82 (43%)
CGM usage	64 (68%)	66 (68%)	130 (68%)
Blood glucose checks per day[1]	5.27 (3.69)	5.61 (3.7)	5.44 (3.69)
HbA1c[2]	8.14 (2.04)	8.02 (1.69)	8.08 (1.85)

Note. M=Mean; *SD*=standard deviation; *n*=sample size; T1D=type 1 diabetes; CGM=Continuous Glucose Monitor; HbA1c=Hemoglobin A1c.

[1] Participants were asked to self-report how many times they check their blood glucose or look at their CGMs per day (ranging from 0 to 15+ times).

[2] HbA1c data was only reported for 88 of the 191 total participants (Narrative condition, n = 42; Standard of Care condition, n = 46).

Table 4. T1D information sources reported by adolescents

Sources	*M (SD)*
Parent/guardian	4.16 (.96)
Doctor	4.09 (.86)
Others with T1D	2.97 (1.18)
Diabetes organizations	2.75 (1.29)
School nurse	2.75 (1.25)
Diabetes websites	2.58 (1.29)
Social media	2.39 (1.26)
Friends	2.19 (1.20)

Note. Participants were asked how often they receive T1D from these sources, with scores ranging from 1 (Never) to 5 (Very often).

Table 5. Factor loadings and descriptive statistics for items and scales

	Factor Loading	*M* (SD)
Message Evaluation		
Emotion (α = .90)		3.76 (.99)
Hopeful	.92	3.79 (1.09)
Encouraged	.85	3.84 (1.03)
Optimistic	.84	3.63 (1.11)
Transportation (α = .80)		3.96 (.69)
I was mentally involved in the messages while reading them.	.80	4.12 (.85)
I wanted to learn how the messages ended.	.76	3.94 (.88)
While reading the messages I had vivid images of what was happening.	.67	4.00 (.96)
The messages affected me emotionally.	.62	3.60 (1.05)
I could picture myself in the scene of the events described in the messages.	.50	4.12 (.86)
PME (α = .88)		4.11 (.72)
Motivated me to get better control over my diabetes management.	.85	4.21 (.81)
Gave me the confidence to have better control over my diabetes management.	.82	4.12 (.88)
Gave me good reasons to get better control over my diabetes management.	.80	4.20 (.78)
Made me think about improving my diabetes management.	.76	4.24 (.83)
Encouraged me to talk to someone about my diabetes management.	.68	3.80 (1.04)
Wishful Identification[1] (α = .83)		3.86 (.72)
The people in the messages are the sorts of people I want to be like.	.88	3.94 (.80)
I would like to do the kinds of things the people in the messages do.	.87	3.93 (.81)
I wish I could be more like the people in the messages.	.65	3.71 (.88)
Psychosocial Outcomes		
Self-efficacy (α = .86)		3.92 (.70)
Manage my diabetes even when I'm overwhelmed.	.82	3.80 (.93)
Check my blood sugar even when I'm really busy.	.77	4.01 (.94)
Manage my diabetes the way my doctor wants me to.	.74	3.91 (.92)
Find ways to deal with feeling frustrated by my diabetes.	.74	3.77 (.93)
Realize things that can make it hard to manage my diabetes.	.64	3.94 (.89)
Talk to my doctor about any problems with my diabetes.	.60	4.09 (.87)
Positive Outcome Expectations (α = .77)		4.18 (.51)
Be in better control of my diabetes.	.73	4.39 (.63)

Feel good about myself.	.66	4.22 (.78)
Be healthy.	.61	4.44 (.61)
Have fewer high blood sugars.	.58	4.34 (.74)
Avoid fighting with my parents/guardians about my diabetes.	.55	4.06 (.90)
Be able to talk to my friends about my diabetes.	.54	3.76 (.99)
Talk more with my doctor about my diabetes.	.50	4.02 (.83)
Negative Outcome Expectations (α = .88)		2.69 (1.02)
Not be able to live the life I want to.	.84	2.57 (1.32)
Not be able to do things with my friends.	.83	2.42 (1.23)
Be on too strict a schedule.	.77	2.72 (1.20)
Be overwhelmed.	.72	2.77 (1.22)
Think too much about my diabetes.	.70	2.99 (1.22)
Diabetes Acceptance (α = .67)		4.10 (.70)
Diabetes is a normal part of my life.	.69	4.08 (.90)
Diabetes is a part of me.	.61	4.16 (.85)
I have fully accepted having diabetes.	.60	4.04 (.97)
Diabetes makes me sad.[1]	—	3.24 (1.27)
Stress and Burnout Perceptions (α = .76)		3.14 (.94)
angry or frustrated.	.83	3.37 (1.16)
stressed, anxious, or overwhelmed.	.76	3.40 (1.09)
unmotivated to do things to fix my diabetes.	.57	2.66 (1.20)
Behavioral Intention (overall) (α = .79)		4.04 (.60)
Behavioral Intention (interpersonal) (α = .75)		3.71 (.82)
Talk to my doctor about how I can better control my diabetes.	.77	3.86 (.96)
Talk with my parents about ways I can better control my diabetes by myself.	.74	3.96 (.90)
Talk to my friends about my diabetes.	.58	3.32 (1.14)
Behavioral Intention (action) (α = .77)		4.28 (.62)
Give myself insulin if my blood sugars are higher than what they should be.	.81	4.36 (.81)
Check my blood sugar (or look at my CGM) when I'm not feeling normal.	.67	4.40 (.75)
Get better control over my diabetes.	.59	4.20 (.79)
Check my blood sugar (or look at my CGM) at least 5 times per day.	.57	4.17 (.88)

Note. M=Mean; *SD*=standard deviation.

[1] Wishful Identification was only measured in the narrative condition.

[2] Item was removed from all analysis.

Table 6. Pearson's correlations of key study variables (*N* = 191)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1
T1D Characteristics																	
1. Age	—																
2. Age of diagnosis	.19*	—															
3. Years with T1D	.23**	-.92**	—														
4. Average glucose checks per day	.00	-.05	.05	—													
5. HbA1c[1]	.06	-.15	.18	-.26*	—												
Message Evaluation																	
6. Emotion	- .06	.00	-.02	-.22**	.11	—											
7. Transportation	.04	.03	-.02	- .18*	.20	.68**	—										
8. PME	-.02	.00	-.01	- .19**	.15	.72**	.69**	—									
9. Wishful Identification[2]	- .11	.10	-.13	- .16	-.03	.66**	.55**	.64**	—								
Psychosocial Outcomes																	
10. Self-efficacy	-.03	.03	-.05	- .07	.04	.46**	.38**	.38**	.24*	—							
11. Positive Outcome Expectations	.02	- .05	.06	- .16*	.19	.55**	.51**	.59**	.53**	.51**	—						
12. Negative Outcome Expectations	.09	- .02	.05	.00	-.06	.05	.07	.00	.13	-.21**	-.21**	—					
13. Diabetes Acceptance	.06	- .10	.13	.01	.07	.29**	.27**	.28**	.19	.41**	.37**	- .21**	—				
14. Stress and Burnout Perceptions	.09	- .02	.06	- .03	.07	.00	.08	.00	.24*	- .21**	- .12	.59**	-.20**	—			
15. Behavioral Intention (overall)	-.01	- .05	.05	.03	.13	.48**	.44**	.53**	.43**	.62**	.72**	- .22**	.42**	- .15*	—		
16. Behavioral Intention (interpersonal)	-.05	.07	-.09	- .17*	.05	.58**	.46**	.57**	.55**	.54**	.68**	- .06	.33**	- .04	.84**	—	
17. Behavioral Intention (action)	.04	-.16*	.17*	.22**	.17	.23**	.29**	.32**	.20	.51**	.53**	- .31**	.38**	- .21**	.84**	.41**	—

Note. *Correlation is significant at the 0.05 level (two-tailed); **Correlation is significant at the 0.01 level (two-tailed).

[1] HbA1c data was only reported for 88 of the 191 total participants (Narrative condition, n = 42; Standard of care condition, n = 46)

[2] Wishful identification was only measured in the narrative condition.

Table 7. T1D message location preferences

Location	Narrative condition *n* = 94 *n* (%)	Standard of Care condition *n* = 97 *n* (%)	Total *n* = 191 *n* (%)
Doctor's office	64 (68%)	81 (84%)	145 (76%)
Diabetes websites	55 (59%)	59 (61%)	114 (60%)
Social media	52 (55%)	60 (62%)	112 (59%)
Diabetes advocacy organizations	49 (52%)	55 (57%)	104 (55%)
School nurse	46 (49%)	53 (55%)	99 (52%)
TV	41 (44%)	43 (44%)	84 (44%)

Note. Participants could select more than one message location preference.

Table 8. Message evaluation measures by study condition

Variable	Narrative condition *n = 94* *M* (*SD*)	Standard of Care condition *n = 97* *M* (*SD*)	Total *n* = 191 *M* (SD)	*p*	Cohen's *d*
Emotion (hopefulness)	3.86 (.92)	3.65 (1.04)	3.76 (.99)	.15	.21
Transportation	4.01 (.76)	3.90 (.61)	3.96 (.69)	.29	.16
Perceived Message Effectiveness	4.13 (.74)	4.10 (.69)	4.11 (.72)	.74	.04
Wishful Identification[1]	3.86 (.72)	---	---	---	---

Note. M=Mean; *SD*=standard deviation.

[1]Wishful Identification was only measured in the narrative condition.

Table 9. Self-efficacy and outcome expectations by study condition

Variable	Narrative condition *n = 94* *M* (*SD*)	Standard of Care condition *n = 97* *M* (*SD*)	Total *n* = 191 *M* (SD)	*p*	Cohen's *d*
Self-efficacy	3.93 (.68)	3.91 (.73)	3.92 (.70)	.80	.03
Outcome Expectations					
Positive	4.17 (.48)	4.18 (.55)	4.18 (.51)	.96	.02
Negative	2.68 (1.06)	2.71 (.98)	2.69 (1.02)	.84	.04

Note. M=Mean; *SD*=standard deviation.

Table 10. Diabetes acceptance and stress and burnout perceptions by study condition

Variable	Narrative condition *n = 94* *M* (*SD*)	Standard of Care condition *n = 97* *M* (*SD*)	Total *n* = 191 *M* (SD)	*p*	Cohen's *d*
Diabetes Acceptance	4.03 (.74)	4.16 (.66)	4.10 (.70)	.19	.19
Stress and Burnout Perceptions	3.13 (1.04)	3.15 (.84)	3.14 (.94)	.91	.02

Note. M=Mean; *SD*=standard deviation.

Table 11. Behavioral intention differences by study condition

Variable	Narrative condition *n = 94* *M* (*SD*)	Standard of Care condition *n = 97* *M* (*SD*)	Total *n* = 191 *M* (SD)	*p*	Cohen's *d*
Behavioral Intention					
Interpersonal	3.66 (.82)	3.77 (.83)	3.71 (.82)	.36	.13
Action	4.28 (.63)	4.29 (.62)	4.28 (.62)	.92	.02
Overall	4.01 (.61)	4.06 (.58)	4.04 (.60)	.54	.08

Note. M=Mean; *SD*=standard deviation.

Table 12. Interaction effects

Variable	Narrative condition *M* (*SD*)	Standard of Care condition *M* (*SD*)
Self-efficacy; *p* = .03		
Pump / CGM[1]	4.09 (.64)	3.82 (.62)
No technology[2]	3.80 (.70)	3.96 (.80)
Self-efficacy; *p* = .04		
Diagnosed before 10[3]	4.00 (.61)	3.74 (.77)
Diagnosed after 10[4]	3.87 (.75)	4.03 (.67)
Transportation; *p* = .01		
Diagnosed before 10[3]	4.12 (.67)	3.75 (.60)
Diagnosed after 10[4]	3.90 (.83)	4.02 (.60)

Note. M=Mean; *SD*=standard deviation.

[1] 86 participants used both an insulin pump and CGM (Narrative condition, n = 43; Standard of care condition, n = 43)

[2] 105 participants did not use any technology (Narrative condition, n = 51; Standard of care condition, n = 54)

[3] 88 participants were diagnosed before the age of 10 (Narrative condition, n = 47; Standard of care condition, n = 41)

[4] 103 participants were diagnosed after the age of 10 (Narrative condition, n = 47; Standard of care condition, n = 56)

REFERENCES

Acuff, L. M., & Jabson, J. M. (2017). Uncertainty and the duration of disease in adults with type 1 diabetes. *PLAID: People Living with and Inspired by Diabetes*, 2, 40–44. doi:10.17125/plaid.2016.85

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., & Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracin, B.T. Johnson, & M.P. Zanna (Eds.), *The handbook of attitudes* (pp. 173–221). Mahwah, NJ: Erlbaum

Allen, M., & Preiss, R. W. (1997). Comparing the persuasiveness of narrative and statistical evidence using meta-analysis. *Communication Research Reports*, 14(2), 125–131.

American Diabetes Association. (2019a). *Costs of diabetes*. Retrieved from http://www.diabetes.org/advocacy/news-events/cost-ofdiabetes.html

American Diabetes Association. (2019b). *Statistics about diabetes*. Retrieved from http://www.diabetes.org/diabetes-basics/statistics/.

Anderson, B., Ho, J., Brackett, J., Finkelstein, D., & Laffel, L. (1997). Parental involvement in diabetes management tasks: Relationships to blood glucose monitoring adherence and metabolic control in young adolescents with insulin-dependent diabetes mellitus. *The Journal of Pediatrics, 130*(2), 257-265. https://doi.org/10.1016/S0022-3476(97)70352-4

Anderson, B. J., Svoren, B., & Laffel, L. (2007). Initiatives to promote effective self-care skills in young patients with diabetes mellitus. *Disease Management and Health Outcomes*, 15, 101–108. http://dx.doi.org/10.2165/00115677-200715020-00005.

Appel, M., Gnambs, T., Richter, T., & Green, M. C. (2015). The Transportation Scale–Short Form (TS–SF). *Media Psychology*, 18(2), 243–266.

Atkin, C. K., & Freimuth, V. (2013). Guidelines for formative evaluation research in campaign design. In R. E. Rice & C. K. Atkin (Eds.), *Public communication campaigns* (4th ed., pp. 53–68). Los Angeles, CA: Sage.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev, 84*(2), 191-215.

Bandura, A., & National Institute of Mental Health. (1986). *Prentice-Hall series in social learning theory. Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ, US: Prentice-Hall, Inc.

Bandura, A. (2004). Health Promotion by Social Cognitive Means. *Health Education & Behavior, 31*(2), 143-164. doi:10.1177/1090198104263660

Barnetz, Z., & Feigin, R. (2012). "We didn't have to talk:" Adolescent perception of mentor–mentee relationships in an evaluation study of a mentoring program for adolescents with juvenile diabetes. *Child and Adolescent Social Work Journal, 29*(6), 463-483. doi:10.1007/s10560-012-0273-1

Berkowitz, J. M., Huhman, M., Heitzler, C. D., Potter, L. D., Nolin, M. J., & Banspach, S. W. (2008). Overview of formative, process, and outcome evaluation methods used in the VERB™ campaign. *American Journal of Preventive Medicine, 34*(6, Supplement), S222-S229. doi:https://doi.org/10.1016/j.amepre.2008.03.008

Berntsson, L., Berg, M., Brydolf, M., & Hellström, A.-L. (2005). Adolescents' experiences of well-being when living with a long-term illness or disability. *Scandinavian Journal of Caring Sciences*, 21, 419–425.

Bigsby, E., Cappella, J. N., & Seitz, H. H. (2013). Efficiently and effectively evaluating public service announcements: Additional evidence for the utility of perceived effectiveness. *Communication Monographs, 80*, 1-23

Boeijinga, A., Hoeken, H., & Sanders, J. (2017). Storybridging: Four steps for constructing effective health narratives. *Health Education Journal, 76*(8), 923-935. doi:10.1177/0017896917725360

Borus, J. S., & Laffel, L. (2010). Adherence challenges in the management of type 1 diabetes in adolescents: Prevention and intervention. *Current Opinion in Pediatrics*, 22(4), 405–411. http://doi.org/10.1097/MOP.0b013e32833a46a7

Braddock, K., & Dillard, J. P. (2016). Meta-analytic evidence for the persuasive effect of narratives on beliefs, attitudes, intentions, and behaviors. *Communication Monographs*, 83(4), 446–467. https://doi.org/10.1080/03637751.2015.1128555

Campbell, T., Dunt, D., Fitzgerald, J. L., & Gordon, I. (2013). The impact of patient narratives on self-efficacy and self-care in Australians with type 2 diabetes: Stage 1 results of a randomized trial. *Health Promotion International*, *30*(3), 438-448. doi:10.1093/heapro/dat058

Campbell, M. S., Schatz, D. A., Chen, V., Wong, J. C., Steck, A., Tamborlane, W. V., & ... Haller, M. J. (2014). A contrast between children and adolescents with excellent and poor control: The T1D exchange clinic registry experience. *Pediatric Diabetes*, 15(2), 110-117. doi:10.1111/pedi.12067

Carpenter, S. (2018). Ten steps in scale development and reporting: A guide for researchers. *Communication Methods & Measures*, 12(1), 25–44. https://doi.org/10.1080/19312458.2017.1396583

Cates, J. R., Ortiz, R. R., North, S., Martin, A., Smith, R., & Coyne-Beasley, T. (2015). Partnering with middle school students to design text messages about HPV vaccination. *Health Promotion Practice*, *16*(2), 244–255. http://doi.org/10.1177/1524839914551365

Centers for Disease Control and Prevention. (2017). *National diabetes statistics report, 2017: Estimates of diabetes and its burden in the United States*. Retrieved from http://www.diabetes.org/assets/pdfs/basics/cdc-statistics-report-2017.pdf

Chiang, J. L., Maahs, D. M., Garvey, K. C., Hood, K. K., Laffel, L. M., Weinzimer, S. A., . . . Schatz, D. (2018). Type 1 diabetes in children and adolescents: A position statement by the American Diabetes Association. *Diabetes Care, 41*(9), 2026-2044. doi:10.2337/dci18-0023

Chih, A. H., Jan, C. F., Shu, S. G., & Lue, B. H. (2010). Self-efficacy affects blood sugar control among adolescents with type 1 diabetes mellitus. *Journal of the Formosan Medical Association*, 109(7), 503-510. doi: S0929-6646(10)60084-8

Cho, H., Shen, L., & Wilson, K. (2014). Perceived realism: Dimensions and roles in narrative persuasion. *Communication Research 41*(6), 828-851.

Corathers, S. D., Kichler, J., Jones, N.-H. Y., Houchen, A., Jolly, M., Morwessel, N., . . . Hood, K. K. (2013). Improving depression screening for adolescents with type 1 diabetes. *Pediatrics, 132*(5), e1395.

Cox, E. D., Fritz, K. A., Hansen, K. W., Brown, R. L., Rajamanickam, V., Wiles, K. E., . . . Moreno, M. A. (2014). Development and validation of PRISM: A survey tool to identify diabetes self-management barriers. *Diabetes Research and Clinical Practice, 104*(1), 126-135. doi:https://doi.org/10.1016/j.diabres.2014.01.015

Cramm, J., Strating, M., Roebroeck, M., & Nieboer, A. (2013). The Importance of General Self-Efficacy for the Quality of Life of Adolescents with Chronic Conditions. *Social Indicators Research*, 113(1), 551–561. https://doi.org/10.1007/s11205-012-0110-0

Daley, B. J. (1992). Sponsorship for adolescents with diabetes. *Health & Social Work*, 17(3), 173–182. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=107493511&site=ehost-live&scope=site

de Graaf, A., Hoeken, H., Sanders, J., & Beentjes, J. W. (2012). Identification as a mechanism of narrative persuasion. *Communication Research*, *39*(6), 802-823.

de Graaf, A., Sanders, J. and Hoeken, H. (2016). Characteristics of narrative interventions and health effects: A review of the content, form, and context of narratives in health-related narrative persuasion research. *Review of Communication Research,* 4, 88–131.

Dillard, J. P., & Shen, L. (2005). On the nature of reactance and its role in persuasive health communication. *Communication Monographs*, 72(2), 144–168. https://doi.org/10.1080/03637750500111815

Dillard, J. P., Weber, K. M., & Vail, R. G. (2007). The relationship between the perceived and actual effectiveness of persuasive messages: A meta-analysis with implications for formative campaign research. *Journal of Communication*, 57, 613-631.

Dougherty, J. P., Lipman, T. H., Hyams, S., & Montgomery, K. A. (2014). Telemedicine for adolescents with type 1 diabetes. *Western Journal of Nursing Research*, *36*(9), 1199-1221. doi:10.1177/0193945914528387

Duke, J. C., Alexander, T. N., Zhao, X., Delahanty, J. C., Allen, J. A., MacMonegle, A. J., & Farrelly, M. C. (2015). Youth's awareness of and reactions to The Real Cost National Tobacco Public Education Campaign. *PLoS One, 10*, e0144827.

El-Khoury, J. R., & Shafer, A. (2016). Narrative exemplars and the celebrity spokesperson in Lebanese anti-domestic violence public service announcements. *Journal of Health Communication, 21*(8), 935-943. doi:10.1080/10810730.2016.1177146

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149-1160. doi:10.3758/BRM.41.4.1149

Fisher, E. B., Thorpe, C. T., McEvoy DeVellis, B., & DeVellis, R. F. (2007). Healthy coping, negative emotions, and diabetes management. *The Diabetes Educator*, 33(6), 1080–1103. https://doi.org/10.1177/0145721707309808

Franklin, V. L., Waller, A., Pagliari, C., & Greene, S. A. (2006). A randomized controlled trial of Sweet Talk, a text messaging system to support young people with diabetes. *Diabetes Med*., 23, 1332–1338.

Franzen, S., Morrel-Samuels, S., Reischl, T.M., & Zimmerman, M.A. (2009). Using process evaluation to strengthen intergenerational partnerships in the youth empowerment solutions program. *Journal of Prevention & Intervention in the Community*, 37(4), 289-301.

Freedland, K. E., Mohr, D. C., Davidson, K. W., & Schwartz, J. E. (2011). Usual and unusual care: Existing practice control groups in randomized controlled trials of behavioral interventions. *Psychosomatic Medicine*, *73*(4), 323–335. http://doi.org/10.1097/PSY.0b013e318218e1fb

Gandhi, K., Vu, B. K., Eshtehardi, S. S., Wasserman, R. M., & Hilliard, M. E. (2015). Adherence in adolescents with type 1 diabetes: Strategies and considerations for assessment in research and practice. *Diabetes management (London, England)*, *5*(6), 485–498. doi:10.2217/dmt.15.41

Gardner, E. (2010). Ease the resistance: *The role of narrative and other-referencing in attenuating psychological reactance to persuasive diabetes messages*. Unpublished dissertation, University of Missouri-Columbia, Colombia, MO.

Guilfoyle, S. M., Crimmins, N. A., & Hood, K. K. (2011). Blood glucose monitoring and glycemic control in adolescents with type 1 diabetes: meter downloads versus self-report. *Pediatric Diabetes*, 12(6), 560–566. https://doi.org/10.1111/j.1399-5448.2010.00735.x

Green, M. C. (2004). Transportation into narrative worlds: The role of prior knowledge and perceived realism. *Discourse Processes*, 38(2), 247–266. doi:10.1207/s15326950dp3802_5

Green, M. C. (2006). Narratives and cancer communication. *Journal of Communication*, 56, S163–S183.

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology*, 79, 701–721.

Green, M. C., Garst, J., & Brock, T. C. (2004). The power of fiction: Determinants and boundaries. In L. J. Shrum (Ed.), *The psychology of entertainment media: Blurring the lines between entertainment and persuasion* (pp. 161-176). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Greening, L., Stoppelbein, L., Konishi, C., Jordan, S. S., & Moll, G. (2006). Child routines and youths' adherence to treatment for type 1 diabetes. *Journal of Pediatric Psychology, 32*(4), 437-447. doi:10.1093/jpepsy/jsl029

Grey, M., Boland, E. A., Davidson, M., Li, J., & Tamborlane, W. V. (2000). Coping skills training for youth with diabetes mellitus has long-lasting effects on metabolic control and quality of life. *The Journal of Pediatrics, 137*(1), 107-113. doi:https://doi.org/10.1067/mpd.2000.106568

Grey, M., Whittemore, R., & Tamborlane, W. (2002). Depression in type 1 diabetes in children: Natural history and correlates. Journal of Psychosomatic Research, 53(4), 907-911. doi:https://doi.org/10.1016/S0022-3999(02)00312-4

Greydanus, D. E. & Hofmann A. D. (1979). Psychological factors in diabetes mellitus. A review of the literature with emphasis on adolescence. *American Journal of Diseases of Children*, 133, 1061–6

Griva, K., Myers, L. B., & Newman, S. (2000). Illness perceptions and self-efficacy beliefs in adolescents and young adults with insulin dependent diabetes mellitus. *Psychology & Health, 15*(6), 733-750. http://dx.doi.org/10.1080/08870440008405578

Grossman, H. Y., Brink, S., & Hauser, S. T. (1987). Self-efficacy in adolescent girls and boys with insulin-dependent diabetes mellitus. *Diabetes Care, 10*(3), 324-329. doi:10.2337/diacare.10.3.324

Hains, A. A., Berlin, K. S., Davies, W. H., Parton, E. A., & Alemzadeh, R. (2006). Attributions of adolescents with type 1 diabetes in social situations. *Relationship with expected adherence, diabetes stress, and metabolic control, 29*(4), 818-822. doi:10.2337/diacare.29.04.06.dc05-1828

Helgeson, V. S., Honcharuk, E., Becker, D., Escobar, O., & Siminerio, L. (2011). A focus on blood glucose monitoring: relation to glycemic control and determinants of frequency. *Pediatric Diabetes*, *12*(1), 25–30. https://doi.org/10.1111/j.1399-5448.2010.00663.x

Hinyard, L. J., & Kreuter, M. W. (2007). Using narrative communication as a tool for health behavior change: A conceptual, theoretical, and empirical overview. *Health Education & Behavior, 34*(5), 777-792. doi:10.1177/1090198106291963

Hoffner, C., & Buchanan, M. (2005). Young adults' wishful identification with television characters: The role of perceived similarity and character attributes. *Media Psychology*, *7*(4), 325–351. https://doi.org/10.1207/S1532785XMEP0704_2

Hood, K. K., Huestis, S., Maher, A., Butler, D., Volkening, L., & Laffel, L. M. B. (2006). Depressive symptoms in children and adolescents with type 1 diabetes: Association with diabetes-specific characteristics. *Diabetes Care, 29*(6), 1389-1391. doi:10.2337/dc06-0087

Hood, K., Peterson, C., Rohan, J., & Drotar, D. (2009). Association between adherence and glycemic control in pediatric type 1 diabetes: a meta-analysis. *Pediatrics*, 124, e1171–e1179.

Iannotti, R. J., Schneider, S., Nansel, T. R., Haynie, D. L., Plotnick, L. P., Clark, L. M., & ... Simons-Morton, B. (2006). Self-efficacy, outcome expectations, and diabetes self-management in adolescents with type 1 diabetes. *Journal Of Developmental And Behavioral Pediatrics*, 27(2), 98-105. doi:10.1097/00004703-200604000-00003

Igartua, J. J., & Barrios, I. (2012). Changing real-world beliefs with controversial movies: Processes and mechanisms of narrative persuasion. *Journal of Communication*, *62*(3), 514-531.

Igartua, J. J., & Casanova, J. (2016). Identification with characters, elaboration, and counterarguing in entertainment-education interventions through audiovisual fiction. *Journal of Health Communication*, *21*(3), 293-300.

Jamiołkowska, M., Jamiołkowska, I., Łuczyński, W., Tołwińska, J., Bossowski, A., & Głowińska Olszewska, B. (2016). Impact of real-time continuous glucose monitoring use on glucose variability and endothelial function in adolescents with type 1 diabetes: New technology—New possibility to decrease cardiovascular risk? *Journal of Diabetes Research*, 2016, 4385312. doi:10.1155/2016/4385312

JDRF. (2013). *Teen Toolkit.* Retrieved from http://www.jdrf.org/wpcontent/uploads/2013/10/JDRFTEENTOOLKIT.pdf

Kreuter, M., Green, M., Cappella, J., Slater, M., Wise, M., & Storey, J. D. (2007). Narrative communication in cancer prevention and control: A framework to guide research and application. *Annals of Behavioral Medicine*, 33(3), 221–235.

Kreuter, M. W., Holmes, K., Alcaraz, K., Kalesan, B., Rath, S., Richert, M., … Clark, E. M. (2010). Comparing narrative and informational videos to increase mammography in low-income African American women. *Patient Education and Counseling*, *81*(Suppl), S6–14. http://doi.org/10.1016/j.pec.2010.09.008

La Greca, A. M., Bearman, K. J., & Moore, H. (2002). Peer relations of youth with pediatric conditions and health risks: promoting social support and healthy lifestyles. *Journal of Developmental & Behavioral Pediatrics,* 23, 271–280.

Lal, R. A., & Maahs, D. M. (2017). Clinical use of continuous glucose monitoring in pediatrics. Diabetes Technology & Therapeutics, 19 (Suppl 2), S-37–S-43. doi:10.1089/dia.2017.0013

Lazarus, R. S. (1991). *Emotion and adaptation*. Oxford, England: Oxford University Press.

Lemanek, K. L., Kamps, J., & Chung, N. B. (2001). Empirically supported treatments in pediatric psychology: Regimen adherence. *Journal of Pediatric Psychology*, 26, 253–275.

Lloyd, S. M., Cantell, M., Pacaud, D., Crawford, S., & Dewey, D. (2009). Brief report: Hope, perceived maternal empathy, medical regimen adherence, and glycemic control in adolescents with type 1 diabetes. *Journal of Pediatric Psychology, 34*(9), 1025-1029. doi:10.1093/jpepsy/jsn141

Lourenco, F. S., Decker, J. H., Pedersen, G. A., Dellarco, D. V., Casey, B. J., & Hartley, C. A. (2015). Consider the source: Adolescents and adults similarly follow older adult advice more than peer advice. *PLOS ONE, 10*(6), e0128047. doi:10.1371/journal.pone.0128047

Luna Nevarez, C. (2013). *Toward an understanding of multimodal narratives in marketing: A comparative analysis of video narratives, graphic narratives and text-only narratives.* Unpublished dissertation, New Mexico State University, Las Cruces, NM.

Mayer-Davis, E. J., Lawrence, J. M., Dabelea, D., Divers, J., Isom, S., Dolan, L., . . . Wagenknecht, L. (2017). Incidence trends of type 1 and type 2 diabetes among youths, 2002–2012. *New England Journal of Medicine, 376*(15), 1419-1429. doi:10.1056/NEJMoa1610187

Mazzocco, P. J., Green, M. C., Sasota, J. A., & Jones, N. W. (2010). This story is not for everyone: Transportability and narrative persuasion. *Social Psychological and Personality Science*, *1*(4), 361-368.

McAdams, B. H., & Rizvi, A. A. (2016). An overview of insulin pumps and glucose sensors for the generalist. *Journal of Clinical Medicine*, *5*(1), 5. doi:10.3390/jcm5010005

McCormack Brown, K., Lindenberger, & Bryant (2008). Using Pretesting to Ensure Your Messages and Materials Are on Strategy. *Health Promotion Practice*, 9(2), 116–122

McGrady, M. E., Laffel, L., Drotar, D., Repaske, D., & Hood, K. K. (2009). Depressive symptoms and glycemic control in adolescents with type 1 diabetes. *Diabetes Care, 32*(5), 804.

Merikangas, K. R., He, J., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., … Swendsen, J. (2010). Lifetime prevalence of mental disorders in US adolescents: Results from the national comorbidity study-adolescent supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry*, 49(10), 980–989. http://doi.org/10.1016/j.jaac.2010.05.017

Monaghan, M., Hilliard, M., Sweenie, R., & Riekert, K. (2013). Transition readiness in adolescents and emerging adults with diabetes: The role of patient-provider communication. *Current Diabetes Reports*, *13*(6), 10.1007/s11892–013–0420–x. http://doi.org/10.1007/s11892-013-0420-x

Moran, M. B., Murphy, S. T., Frank, L., & Baezconde-Garbanati, L. (2013). The ability of narrative communication to address health-related social norms. *International Review of Social Research*, *3*(2), 131–149.

Moyer-Gusé, E., & Nabi, R. L. (2010). Explaining the effects of narrative in an entertainment television program: Overcoming resistance to persuasion. *Human Communication Research*, 36(1), 26–52. https://doi.org/10.1111/j.1468-2958.2009.01367.x

Murphy, S. T., Frank, L. B., Chatterjee, J. S., & Baezconde-Garbanati, L. (2013). Narrative versus nonnarrative: the role of identification, transportation, and emotion in reducing health disparities. *Journal of Communication*, 63(1), 116–137. https://doi.org/10.1111/jcom.12007

Mulvaney, S. A., Hood, K. K., Schlundt, D. G., Osborn, C. Y., Johnson, K. B., Rothman, R. L., & Wallston, K. A. (2011a). Development and initial validation of the barriers to diabetes adherence measure for adolescents. *Diabetes Research & Clinical Practice*, 94(1), 77–83. https://doi.org/10.1016/j.diabres.2011.06.010

Mulvaney, S. A., Rothman, R. L., Osborn, C. Y., Lybarger, C., Dietrich, M. S., & Wallston, K. A. (2011b). Self-management problem solving for adolescents with type 1 diabetes: Intervention processes associated with an internet program. *Patient Education and Counseling*, *85*(2), 140–142. http://doi.org/10.1016/j.pec.2010.09.018

Mulvaney, S. A., Anders, S., Smith, A. K., Pittel, E. J., & Johnson, K. B. (2012). A pilot test of a tailored mobile and web-based diabetes messaging system for adolescents. *Journal Of Telemedicine & Telecare***.** 18(2), 115–8. doi: 10.1258/jtt.2011.111006.

Nabi, R. L. (2010). The case for emphasizing discrete emotions in communication research. *Communication Monographs*, 77, 153–159.

Nabi, R. L. (2015). Emotional flow in persuasive health messages. *Health Communication*, 30, 114–124.

Nabi, R. L., & Myrick, J. G. (2018). Uplifting fear appeals: Considering the role of hope in fear-based persuasive messages. *Health Communication*, 1-12. doi:10.1080/10410236.2017.1422847

National Collaborating Centre for Women's and Children's Health. (2015). *Diabetes (type 1 and type 2) in children and young people: Diagnosis and management*. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK315806/

Neylon, O. M., O'Connell, M. A., Skinner, T. C. and Cameron, F. J. (2013), Demographic and personal factors associated with metabolic control and self-care in youth with type 1 diabetes: A systematic review. *Diabetes Metabolism Research and Review*, 29: 257-272. doi:10.1002/dmrr.2392

Niederdeppe, J., Shapiro, M. A., & Porticella, N. (2011). Attributions of responsibility for obesity: Narrative communication reduces reactive counterarguing among liberals. *Human Communication Research*, 37(3), 295–323. https://doi.org/10.1111/j.1468-2958.2011.01409.x

Noar, S. M. (2006). A 10-year retrospective of research in health mass media campaigns: Where do we go from here? *Journal of Health Communication*, 11(1), 21-42.

Noar, S. M., Barker, J., Bell, T., & Yzer, M. (2018). Does perceived message effectiveness predict the actual effectiveness of tobacco education messages? A systematic review and meta-analysis. *Health Communication*, 1-10. doi:10.1080/10410236.2018.1547675

Noar, S. M., Bell, T., Kelley, D., Barker, J., & Yzer, M. (2018). Perceived message effectiveness measures in tobacco education campaigns: A systematic review. *Communication Methods & Measures.* doi:10.1080/19312458.2018.1483017

Oris, L., Rassart, J., Prikken, S., Verschueren, M., Goubert, L., Moons, P., … Luyckx, K. (2016). Illness identity in adolescents and emerging adults with type 1 diabetes: Introducing the illness identity questionnaire. *Diabetes Care*, *39*(5), 757–763. https://doi.org/10.2337/dc15-2559

Ott, J., Greening, L., Palardy, N., Holderby, A., & DeBell, W. K. (2000). Self-efficacy as a mediator variable for adolescents' adherence to treatment for insulin-dependent diabetes mellitus. *Children's Health Care, 29*(1), 47-63. doi:10.1207/S15326888CHC2901_4

Palmer, E. (1981). Shaping persuasive messages with formative research. In R. E. Rice & W. Paisley (Eds.), *Public Communication Campaigns* (pp. 227-242). Beverly Hills, CA: Sage.

Rami, B., Popow, C., Horn, W., Waldhoer, T., & Schober, E. (2006). Telemedical support to improve glycemic control in adolescents with type 1 diabetes mellitus. *European Journal of Pediatrics*, 165(10), 701–705. https://doi.org/10.1007/s00431-006-0156-6

Petty R.E., & Cacioppo J.T. (1986) The Elaboration Likelihood Model of Persuasion. In: Communication and Persuasion. Springer Series in Social Psychology. Springer, New York, NY

Schmitt, A., Reimer, A., Kulzer, B., Icks, A., Paust, R., Roelver, K.-M., … Hermanns, N. (2018). Measurement of psychological adjustment to diabetes with the diabetes acceptance scale. *Journal of Diabetes & Its Complications*, 32(4), 384–392. https://doi.org/10.1016/j.jdiacomp.2018.01.005

Schulman-Green, D. , Jaser, S. , Martin, F. , Alonzo, A. , Grey, M. , McCorkle, R. , Redeker, N. S., Reynolds, N. and Whittemore, R. (2012), Processes of Self-Management in Chronic Illness. *Journal of Nursing Scholarship*, 44: 136-144. doi:10.1111/j.1547-5069.2012.01444.x

Silverstein, J., Klingensmith, G., Copeland, K., Plotnick, L., Kaufman, F., Laffel, L., Deeb, L., Grey, M., Anderson, B., Holzmeister, L.A., & Clark, N. (2005). Care of children and adolescents with type 1 diabetes: A statement of the American Diabetes Association. *Diabetes Care*, 28(1), 186-212.

Shafer, A., Cates, J. R., Diehl, S. J., & Hartmann, M. (2011). Asking mom: Formative research for an HPV vaccine campaign targeting mothers of adolescent girls. *Journal of Health Communication, 16*(9), 988-1005. doi:10.1080/10810730.2011.571343

Shen, F., Sheer, V. C., & Li, R. (2015). Impact of narratives on persuasion in health communication: A meta-analysis. *Journal of Advertising*, 44(2), 105–113. https://doi.org/10.1080/00913367.2015.1018467

Sherwani, S. I., Khan, H. A., Ekhzaimy, A., Masood, A., & Sakharkar, M. K. (2016). Significance of HbA1c test in diagnosis and prognosis of diabetic patients. *Biomarker insights*, *11*, 95–104. doi:10.4137/BMI.S38440

Slater, M. D., & Rouner, D. (2002). Entertainment-education and elaboration likelihood: Understanding the processing of narrative persuasion. *Communication Theory*, 12(2), 173–191. doi:10.1111/j.1468-2885.2002.tb00265.x.

Teitcher, J. E. F., Bockting, W. O., Bauermeister, J. A., Hoefer, C. J., Miner, M. H., & Klitzman, R. L. (2015). Detecting, preventing, and responding to "fraudsters" in internet research: Ethics and tradeoffs. *The Journal of law, medicine & ethics : a journal of the American Society of Law, Medicine & Ethics, 43*(1), 116-133. doi:10.1111/jlme.12200

Thomas, A. M., Peterson, L., & Goldstein, D. (1997). Problem solving and diabetes regimen adherence by children and adolescents with IDDM in social pressure situations: A reflection of normal development. *Journal of Pediatric Psychology, 22*(4), 541-561. doi:10.1093/jpepsy/22.4.541

Thompson, T. & Kreuter, M. W. (2014). Using written narratives in public health practice: A creative writing perspective. *Preventing Chronic Disease,* 11, 130402.

U.S. News & World Report. (2019). *North Carolina Children's Hospital at UNC: Rankings & Ratings*. Retrieved from https://health.usnews.com/best-hospitals/area/nc/north-carolina-childrens-hospital-at-unc-PA6360260/pediatric-rankings/diabetes-and-endocrinology

Verchota, G., & Sawin, K. J. (2016). Testing components of a self-management theory in adolescents with type 1 diabetes mellitus. *Nursing Research, 65*(6), 487-495. doi:10.1097/nnr.0000000000000180

Young, M. T., Lord, J. H., Patel, N. J., Gruhn, M. A., & Jaser, S. S. (2014). Good cop, bad cop: Quality of parental involvement in type 1 diabetes management in youth. *Current Diabetes Reports, 14*(11), 546. doi:10.1007/s11892-014-0546-5

Yzer, M., LoRusso, S., & Nagler, R. H. (2015). On the conceptual ambiguity surrounding perceived message effectiveness. *Health Communication, 30*, 125-134.

Zebregs, S., Neijens, P., de Graaf, A., & van den Putte, B. (2015). The differential impact of statistical and narrative evidence on beliefs, attitude, and intention: A meta-analysis. *Health Communication*, 30(3), 282–289. https://doi.org/10.1080/10410236.2013.842528

Ziegler, R., Heidtmann, B., Hilgard, D., Hofer, S., Rosenbauer, J., & Holl, R. (2011). Frequency of SMBG correlates with HbA1c and acute complications in children and adolescents with type 1 diabetes. *Pediatric Diabetes*, *12*(1), 11-17. doi:10.1111/j.1399-5448.2010.00650.x

Zillmann, D., Gibson, R., & Sargent, S. L. (1999). Effects of photographs in news-magazine reports on issue perception. *Media Psychology*, *1*(3), 207-228.

Zolnierek, K. B., & Dimatteo, M. R. (2009). Physician communication and patient adherence to treatment: a meta-analysis. *Medical Care*, *47*(8), 826–834. doi:10.1097/MLR.0b013e31819a5acc