ATHABASCA UNIVERSITY

DEVELOPMENT OF A HEALTH LITERACY TOOL TO SUPPORT CERTIFIED DIABETES EDUCATORS DURING VIRTUAL VISITS

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Abstract

Using a Quality Improvement (QI) approach, this qualitative study intended to develop a health literacy assessment tool or to modify existing tools that can assess the health literacy of individuals diagnosed with diabetes during their virtual consultations with Certified Diabetes Educators (CDEs). Accurately assessing the health literacy levels of individual clients will ultimately enable CDEs to customize education for their clients that will better support the self-management of their diabetes. While self-management leads to improvement in clinical outcomes, this study is focused on helping CDEs to better understand the diabetes health literacy level of their clients. Due to accessibility issues for the elderly and other clients, the study focused on the telephone visit as a preferred type of virtual visit. Virtual consultations reduce barriers for the elderly and other clients, including those with disabilities, who find travelling difficult and cannot physically access a clinic. Accessing technology exposes inequity issues; the telephone is accessible to most people, whereas in-person consultations at a clinical facility or consultations using audio-visual technology are not. In this qualitative research study, existing health literacy tools were assessed and in virtual consultations between Certified Diabetes Educators (CDEs), a new diabetes health literacy tool was developed. Using an interpretive quality improvement approach, the participants' (CDEs) perspectives on the effectiveness and practicality of the existing diabetes health literacy tools were assessed. CDEs’ views on the tools' application in practice were assessed through a focus group session. Based upon feedback from CDEs, a new diabetes health literacy tool was developed, and finally, the participants assessed the new tool in their virtual practice. CDEs selected telephone visits along with newly developed health literacy tools for their initial assessments of clients' health literacy. The study was conducted over several phases, and the data was collected using focus groups and open-ended surveys. Overall, CDEs found that having a diabetes health literacy tool is beneficial in their practice setting and allowed them to better understand their clients' needs; however, the tool needs to be further improved to adapt to the specific variety of conditions including type 1 and 2 diabetes and prediabetes.

Keywords: health literacy, health literacy tool, diabetes education, self-management, telemedicine, virtual visit, telephone visit

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Definition of Terms and Abbreviations

Client: Individual seeking healthcare or treatment.

CDEPO: Community Diabetes Education Program of Ottawa. The largest diabetes education program in Ottawa.

Certified Diabetes Educators (CDEs): CDE is a healthcare provider, dedicated to excellence in diabetes education and has a comprehensive knowledge of diabetes care and education, as well as proper communication skills. Diabetes educators have already passed the Canadian Diabetes Educators Certification Board (CDECB) exam and help educate clients regarding diabetes management (The Canadian Diabetes Educator Certification Board, 2023).

Glycemic Control: Blood glucose management to the target ranges as defined by the Diabetes Canada Clinical Practice Guidelines.

Healthcare providers (HCPs): Healthcare providers include professionals of medical care, including physicians, physician assistants, nurse practitioners, nurses, dietitians, Certified Diabetes Educators and exercise physiologists, as well as those who provide health education and develop educational programs.

Health literacy: Health literacy is defined as a collection of capabilities including performing basic reading and numerical tasks that are essential to function in a healthcare environment, which comprise the ability to read and comprehend the necessary health-related materials (The American Medical Association's Ad Hoc Committee on Health Literacy, 1999).

Hypoglycemia: Hypoglycemia is any blood glucose below 4 mmol/L that can compromise mental function (Yale et al., 2018).

Reading literacy: “Understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, develop one's knowledge and potential, and participate in society” (OECD, 2002).

Self-management skills: Self-management skills are actions clients take to manage their health conditions. These activities can include physical activity, following nutritional guidelines, taking medications as prescribed, monitoring blood glucose levels, responding appropriately to the raise and drop in blood glucose levels, treating hypoglycemia episodes and preventing the recurrence of hypoglycemia episodes.

Tertiary care: Most advanced level of care is usually provided in hospital settings.

Tool: A tool in this proposal refers to a questionnaire with a series of selected questions.

Traditional Ambulatory Practices: Traditional in-clinic or outpatient practices.

Virtual Visit: From a clinical perspective, it is a method of education and care delivery to clients located at a distance from the healthcare providers. Healthcare providers use a variety of terms such as telemedicine, phone visit, video visit, and virtual visit when referring to virtual visits of clients.

Chapter 1: Introduction

In this introductory chapter, I include the overview and background of the study, the role of health literacy and education in the management of diabetes, a statement of the problem and purpose of the study, my research question and sub-questions, and the significance of this research. Additionally, I provide an introduction to my methodological approach and state the study's limitations.

Overview and Background of the Study

My background as a nurse led me to my role as an educator working with clients who have diabetes, are not hospitalized, and require ongoing healthcare. The overarching goal of this study was to find or develop a health literacy tool that can help healthcare providers (HCPs) better understand their clients' health literacy. As a HCP, a nurse, and a Certified Diabetes Educator (CDE), I aim for client-centered care. While working with individuals with chronic conditions, I recognized the importance of assessing clients' needs before initiating interventions such as diabetes education. A better grasp of each client's requirements has assisted me in providing individualized care. In the context of this study, I used the term client to refer to those who receive diabetes education and healthcare during virtual consultations with HCPs who are certified diabetes educators (CDEs). My study focused on the importance of assessing the health literacy of clients with type 2 diabetes during their virtual visits at the community diabetes program where I work.

Prevalence and Cause of Diabetes

In Canada, approximately 549 new cases of diabetes are diagnosed each day, and 8.8 percent of Canadians are living with diabetes (LeBlanc et al., 2019). Diabetes is a chronic condition that leads to an elevation in blood glucose levels in the body caused by insulin deficiency and/or insulin resistance. The number of people diagnosed with diabetes continues to increase yearly, with an estimated 11 million Canadians living with some form of diabetes in 2019 (Diabetes Canada, 2019). Unmanaged diabetes can lead to complications such as heart attacks, strokes, kidney disease, vision problems, blindness, and amputations (Chaudhury et al., 2017). Moreover, risks can be higher among Indigenous peoples, Black, and South Asian Canadians, who are reported to have higher incidences of diabetes (LeBlanc et al., 2019). My study focused primarily on clients living with type 2 diabetes which is noted by Diabetes Canada (2019) as being more prevalent. In Canada, 90% of diabetes cases are type 2 diabetes (Diabetes Canada (2019).

Management of Diabetes

Multiple factors, such as eating habits, physical activity, medications, stress and illness can impact clients' management of their diabetes (Sherifali et al., 2018). Therefore, self-management is a critical factor in dealing with this chronic condition, and proper education is required to enable self-management (Meng et al., 2016). Medications can improve blood glucose levels, but individuals are at risk for hypoglycemia without proper self-care management. Hypoglycemia is any blood glucose below 4 mmol/L that can compromise mental functions, and untreated hypoglycemia can lead to loss of consciousness or death (Yale et al., 2018).

Education, Health Literacy, and Management of Diabetes

Client-specific education can help individuals living with diabetes monitor and manage the progression of the disease outside of tertiary care settings and shift that to their living community. Community programs help support the management of diabetes in the community setting by providing education and care to clients (Philis-Tsimikas & Gallo, 2014). Studies suggest that education in chronic disease management results in a reduction in hospitalization rates (Koelling et al., 2005; VanSuch et al., 2006), and hospital readmission is reduced when HCPs provide opportunities for diabetes education to clients (Healy et al., 2013). Self-management education is essential for people dealing with chronic conditions such as diabetes. Diabetes management is known to lead to improved clinical outcomes (Funnell et al., 2011). To support client adherence, management plans should be congruent with their values, culture, lifestyles, and priorities (Powell et al., 2015).

One of the risk factors for inadequate self-management in those living with diabetes is low health literacy levels. Health literacy is defined as a collection of capabilities including performing basic reading and numerical tasks that are essential to function in a healthcare environment, which comprise the ability to read and comprehend the necessary health-related materials (The American Medical Association's Ad Hoc Committee on Health Literacy, 1999). In their 2019 study, Rafferty and colleagues reported that individuals with chronic conditions who had lower health literacy were less likely to attend in-person educational sessions due to a lack of understanding of the seriousness of their conditions. Furthermore, the authors found that low health literacy is a potential barrier to improving diabetes self-management and health (Rafferty et al., 2021).

Understanding clients' health literacy has been identified as the first factor in helping HCPs to understand their clients’ needs (Adams, 2010). Adults with lower health literacy are less likely to ask questions or seek support (Katz et al., 2007; Rafferty et al., 2021). As an HCP who provides diabetes education, I have personal experience in assessing the understanding of clients’ knowledge regarding diabetes self-management. The lack of visual cues during virtual visits can make it more challenging to understand clients’ needs, especially those who are marginalized and have lower health literacy (Glauser, 2020). Additionally, HCPs are concerned that they might miss important information during virtual visits (Glauser, 2020). While low health literacy is a barrier to improving diabetes self-management and quality of life, knowledge of a client’s health literacy can help HCPs tailor education to meet individual needs. I have found that it is more challenging to assess and understand clients' knowledge at a distance which makes effective health literacy assessment an even greater necessity during virtual visits.

Access, Consultation, and Education

Face-to-face (in-person) visits between clients and HCPs have been the norm for diabetes education and care; however, virtual visits over the telephone have increased due to COVID-19 pandemic restrictions on in-clinic visits (Omboni et al., 2022; Topo, 2020). Clients need to understand when and how to properly and safely adjust their medications and insulin because mistakes can increase their risk of developing hypoglycemia. In 2020, because individuals with diabetes have a higher risk of contracting COVID-19, public health agencies advised their clients to seek the advice of their HCPs before visiting a clinic (Centres for Disease Control and Prevention, 2020; Diabetes Canada, 2020). Consequently, virtual visits have been conducted over the telephone since the pandemic, providing clients with education to improve their diabetes self-management (Diabetes Canada, 2020). Virtual visits have been ongoing since the beginning of the pandemic (Diabetes Canada, 2020).

Many clients living in remote communities with no physical access to a diabetes educator, utilized remote care prior to the global pandemic. Accessibility to a diabetes educator may also be a challenge for clients struggling with transportation issues, namely the elderly, persons with disabilities and other clients who find it difficult to travel due to issues with transportation and mobility accessibility (Strauss et al., 2006; Zgibor et al., 2011). The COVID-19 pandemic has highlighted the importance of using virtual visits (de Lima Filho et al., 2020; Topol, 2020) in providing education at a distance.

The medical profession was the first to adopt the phone to communicate, assess, and monitor health-related issues, and deliver the healthcare information and education services from a distance (Zundel, 1996). From a clinical perspective, virtual visits can provide opportunities for education and care service delivery to clients located at a distance from the healthcare providers. Healthcare providers use various terms such as telemedicine, phone visit, video visit, and virtual visit when referring to virtual visits with clients. Virtual consultations can be audio or audiovisual visits. For the continuity of education and care, virtual visits by telephone and videoconferencing can support clients if they cannot make face-to-face visits to a clinic (Hakim et al., 2020).

Due to the COVID-19 pandemic, the number of virtual visits has increased significantly with the aim of protecting vulnerable communities (Triana et al., 2020; Topol, 2020). The pandemic created a more challenging context for diabetes management in the general population, especially for those with access issues, including access to technology due to visual impairment, memory limitations, or socioeconomical limitations (Egede et al., 2021). The telephone provides a more generally accessible medium for virtual assessment, education, and care related to chronic health conditions such as type 2 diabetes. As noted by the Report of the Task Team on Equitable Access (Health Canada, 2021), throughout the COVID-19 pandemic, "the vast majority of virtual care was delivered through a modality of communication that is almost universally accessible, the telephone, as opposed to other modalities such as video conferencing or secure messaging" (p. 26). One Quebec study revealed that during the pandemic, less than 3% of physicians conducted video visits, but more than 80% of them reported providing telephone consultations (Breton et al., 2021). Factors associated with limitations for lower usage of video visits were noted to be clinicians' lower comfort with technology, older age of clients, lower socioeconomic status of clients, and being a member of a minority group (Crotty et al., 2021).

Statement of the Problem

It is difficult for HCPs to assess their clients during virtual phone visits due to a lack of visual cues, which can result in the loss of important information (Glauser, 2020). Furthermore, the lack of individualized care and education provided by HCPs can be a barrier to diabetes management (Brämberg et al., 2012; Saunders, 2019). Understanding every client's unique healthcare needs and adapting educational information to align with each individual's health literacy level is essential (ACOG, 2016). Client-centered care creates a safe environment for people to exchange information with the HCP (Inzucchi et al., 2012). Understanding a client's health literacy can help HCPs tailor education to the client's needs; hence, improving client satisfaction (Watts et al., 2017). Through a critical review of the literature, I identified gaps in the knowledge of and research related to the HCPs' understanding of their clients' health literacy level in diabetes self-management.

Purpose of the Study

This research study was conducted to find and assess the existing diabetes health literacy tools to identify a tool that is best suited for HCPs to use during virtual visits with their clients by telephone. The aim was to improve HCPs' assessment and understanding of the health literacy of clients with diabetes during virtual consultations. A good understanding of the health literacy of individuals with type 2 diabetes will enable HCPs to customize educational materials and services for their clients.

Research Questions

The main question:

> How can HCPs' assessment of the health literacy levels of diabetes clients be improved during virtual visits?

The sub-questions:

How practical are the existing health literacy assessment tools in clinical practice during virtual visits using the telephone?

Can existing health literacy tools be improved, and if not, can a more effective and practical tool be developed?

Significance of the Study

This practice-based study was implemented to support client centered-care provided by diabetes educators working in a clinical setting. Diabetes is a chronic condition that requires education personalized to clients' needs. Therefore, it is necessary to assess the health literacy of clients with Type 2 diabetes during their virtual visits with diabetes healthcare providers over the phone. Ultimately, health literacy assessment will allow HCPs to tailor educational materials for their clients. This study sought to assess existing health literacy tools, create a new tool, if necessary, and have HCPs evaluate the tool in practice during virtual visits with their clients.

Scope of the Study

Diabetes was selected as the focal chronic condition in this study due to its complexity. A person living with diabetes requires relevant and understandable educational information, and interventions related to their blood glucose levels, including carbohydrate intake, physical activity, and insulin and medications, in order to properly manage diabetes. This research study focused on the assessment of existing health literacy tools and the development of a new health literacy tool followed by use in virtual consultations between Certified Diabetes Educators (CDEs) and their clients in a Community Diabetes Education Program in one of the many diabetes education centres in Ontario, Canada. Using a qualitative approach and interpretive quality improvement approach, I collected participants' (CDEs) perspectives on the effectiveness and practicality of the existing diabetes health literacy tools during virtual visits. I heard their views on the tools' application in practice through focus group session. Additionally, based upon feedback from CDEs, I developed a new diabetes health literacy tool, and finally, I had the participants re-assess the new tool.

Methodology

A quality improvement (QI) approach was deemed to be the most suitable methodology for my research study. The role of QI in research relies on the implementation of a new intervention which aims to advance the care of clients (Baker, 2006; Grol et al., 2002; The University of Kansas Medical Center, 2019). Additionally, QI research is used when assessing a new approach that has yet to be widely studied or developed (The University of Kansas Medical Center, 2019). First, this research study aimed to assess existing health literacy tools for applicability in the practice setting by CDEs who work directly with clients who have diabetes. Second, the goal was to either improve an existing diabetes health literacy tool or develop a new tool that would help CDEs to assess the health literacy of their clients. Since this study fell within the QI category involving research components as a new initiative to gain knowledge on the applicability of existing health literacy tools in practice, it required ethics approval from Athabasca University's Research Ethics Boards, which was obtained prior to starting the research study (Research Ethics Office, 2020) (Appendix A).

Limitations

Due to the diverse size and client focus of each diabetes community program across Canada, this study was only conducted with the Community Diabetes Education Program in Ottawa (CDEPO), which is the largest diabetes program in Ottawa.

Conclusion

In this chapter, I provided an overview and purpose of the study, a clear statement of the problem, my research questions, and the scope and limitations of the study. While diabetes is a chronic condition that is both complex and irreversible, education about diabetes and how it can be managed can improve the quality of life for those living with this condition. Low health literacy is a potential barrier to improving diabetes self-management and health. Attention to health literacy allows individuals with diabetes to better understand the various factors involved in self-management. In order to support their clients, HCPs must provide educational information that their clients can understand. Therefore, client health literacy needs to be accurately measured. Assessment is even more important when care is being provided virtually, and the lack of visual cues creates a further barrier to assessing clients' health literacy related to their condition.

In the next chapter, I present my literature review, highlighting existing health literacy tools and their practical application. In Chapter 3, I present my theoretical framework. In Chapter 4, I describe the methodology and procedures for my study, including my positionality, research questions, research design, and procedures. In Chapter 5, I present my findings and in Chapter 6, I discuss the results of my study and provide my conclusion.

Chapter 2: Literature Review

Diabetes is a chronic condition, and its prevalence is increasing (Pal et al., 2018). It is estimated that 11 million Canadians live with diabetes and that diabetes contributes to 41,500 deaths yearly in Canada alone (Diabetes Canada, 2019). Successful management of chronic diseases, such as diabetes, requires clients to learn a great deal of information about the condition, its management, and treatment strategies to prevent further complications (Gonzalez et al., 2016). Improved self-management of diabetes leads to improved clinical outcomes, such as glycemic control (Khairnar et al., 2019). Self-management can be supported through diabetes education; however, individuals with lower health literacy have poorer diabetes self-management and higher rates of complications (Yale et al., 2018). To date, multiple health literacy tools have been developed, with some being specific for diabetes assessment; however, their applicability in a clinical setting is questionable (Jordan et al., 2011).

Diabetes and Self-Management

Diabetes is both complex and irreversible; however, it can be a manageable chronic condition for most individuals. Unmanaged diabetes can interfere with activities of daily living (Brämberg et al., 2012). From an ontological and epistemological positioning, Storni (2015) noted that diabetes is a complex condition that affects daily living rather than an illness or scientific disease. Self-management and behavioural adaptations are required to improve the management of diabetes. Diabetes self-management is about empowering clients to take control of their lives and improve their health (Storni, 2015). Supportive education to promote a better understanding of diabetes management is required to meet many clients' needs (Pal et al., 2018). A client's lack of participation in self-care could negatively impact their awareness of their quality of care, lead to poorer health outcomes, increase preventable healthcare costs, and can have a financial impact on society (Docteur & Coulter, 2012).

Storni (2015) acknowledges that while biomedical technologies such as virtual visits and telemonitoring exist to improve client health, it is essential to consider the client's needs and understanding to help with gradual knowledge transfer and client empowerment. Diabetes self-management requires an active participation of the client and their caregivers. The modern medical paradigm of separating the client from the disease is not a recipe for success. Diabetes self-management takes into account multiple methods and ways of acquiring knowledge because every individual and their experiences are different. It is essential to adapt education to personal needs and levels of understanding. Clients can be empowered to improve their health if their knowledge of the information is enhanced and support is provided to them based on their needs. Due to the complexity of diabetes, two individuals living with this condition cannot be treated the same way, and they cannot be expected to live the same way because their health literacy and understanding of the educational information are different (Storni, 2015).

Barriers to Diabetes Self-Management

One of the barriers to self-management is access to diabetes care. Studies reveal significant barriers to accessing diabetes education. For example, when clients have to travel long distances to their primary care clinic for face-to-face appointments, diabetes management may be more difficult (Strauss et al., 2006; Zgibor et al., 2011). Additionally, physical access to healthcare services and access to transportation (Saunders, 2019; Zgibor et al., 2001) can be barriers to diabetes management. In particular, older adults experience challenges when travelling to clinics (Zgibor et al., 2011), especially during winter or when regular and intense follow-up is needed.

Virtual visits and telehealth can remove travel and transportation barriers while creating an accessible means for delivering care to individuals with chronic conditions (Kelley et al., 2020). The need to move face-to-face clinic visits to a virtual modality has become more pronounced during the COVID-19 pandemic. Many healthcare and other providers are examining distance delivery of services, such as virtual visits, which are particularly important for diabetes clients who are at higher risk for complications if they contract COVID-19.

Another barrier to self-management is the absence of individualization in diabetes care. Cumbie et al. (2004) mentioned the importance of personalized care in chronic illness self-management while taking into consideration clients' bio-psycho-social and spiritual needs. Studies reveal that a lack of individualized care by diabetes educators can be a barrier to diabetes management (Brämberg et al., 2012; Saunders, 2019). Understanding clients' unique healthcare needs and adapting educational information consistent with their health literacy level is essential (ACOG, 2016). Lower health literacy can negatively affect diabetes self-management (Yale et al., 2018). A lack of consideration for clients' existing health literacy levels can prevent individuals from following medical instructions related to nutrition and medication, thereby worsening their medical condition (Nam et al., 2011). For instance, clients can learn diabetes management techniques such as insulin injections more easily than insulin titration because the latter requires complex problem-solving skills involving self-management (Bonnet et al., 1998). Self-management requires understanding and maintaining information to perform proper self-care (Bonnet et al., 1998).

Individualization of care requires an understanding of the client's lifestyle and preferences. Client-centered care creates a safe environment for people to exchange information with healthcare providers (HCPs) (Inzucchi et al., 2012). A client's satisfaction can be improved through further understanding of the client's health literacy level and tailoring education to the client's needs (Watts et al., 2017). Critical pedagogy offers one approach to assessing health literacy. Three fundamental elements of critical pedagogy are dialogue and reflection, problem-posing, and problem-solving (Dawkins-Moultin et al., 2016). Dialogue and reflection focus on determining precise health literacy needs (Dawkins-Moultin et al., 2016). Problem posing aims to explain the reasons underlying problems, and problem-solving investigates resolutions. (Matthews, 2014). These fundamental elements provide a broader view when assessing a client's health literacy. HCPs need to understand health literacy in order to properly assess clients' health literacy to support self-management (Saunders et al., 2019). An initial assessment of the client's health literacy serves as a first step toward changing the healthcare provider's behaviour (McNeil & Arena, 2017).

Virtual Visits

Information communication technologies such as the telephone have existed since 1876 (Baumann & Scales, 2016). The healthcare system was the first to accept the phone to communicate, monitor, and provide healthcare services from a distance (Zundel, 1996). In order to ensure continuity of care, virtual visits by telephone and video can help support clients if they are not able to attend face-to-face visits at the clinic (Hakim et al., 2020). The pandemic has caused new challenges in managing diabetes in the general population, particularly for the elderly (de Lima Filho et al., 2020).

Videoconferencing

Videoconferencing between the client and the Healthcare Provider (HCP) offers a biopsychosocial model of health (Triana et al., 2020), which looks at illness and healthcare holistically and considers the influence of psychological and social factors (Wade & Halligan, 2017). Through video conferencing, healthcare providers can connect and communicate with clients in real time and address their concerns. Additionally, videoconferencing provides an opportunity to connect to clients within their home environments (Triana et al., 2020). Technologies increase accessibility and quality care by allowing clients to communicate with healthcare providers, helping clinicians manage the continuously increasing workload at a lower cost to the system (Schwamm, 2014).

Despite the availability of various platforms for videoconferencing, the reality is that this form of communication is not accessible to everyone. As discussed by Nouri et al. (2020), worldwide telehealth implementation may increase inequalities in access to healthcare for individuals in the general population with limited access, including individuals who live in rural areas, individuals from minority groups, low-income individuals, and those with low health literacy. Even if individuals have access to a cellphone or computer, not all use e-mail or text messaging, or have internet access (Bulman et al., 2020; Gell et al., 2015). Smartphone features are not always accessible to the elderly (Anam & Abid, 2020).

Therefore, despite health and e-health programs, the lack of access puts the elderly at a disadvantage (Gell et al., 2015). The literature suggests that the telephone can provide greater access to care (Anam & Abid, 2020; Bulman et al., 2020).

Telephone Visits

Providing education to clients via the telephone can empower individuals living with diabetes in the self-management of their chronic condition (Zamanzadeh et al., 2017). Telehealth creates a more client-centered approach by providing an alternative to existing traditional ambulatory and hospital-based practices (Schwamm, 2014). Diabetes nurse educators coaching clients via telehealth can improve clients' health behaviour in diabetes management, especially in rural areas (Young et al., 2014). Evidence shows that telehealth can improve glycemia and other health-related outcomes and that those improvements are sustained for a longer duration compared to in-clinic visits (McDonnell, 2018).

Improving Virtual Visits

Having access to both telephone and video visits provides a greater selection for clients (Nouri et al., 2020) and allows clients to choose the method of delivery of care (Bulman et al., 2020). Understanding clients' needs will help them feel that they are an integral part of the care team (LaDonna et al., 2017). Continuity of care, the relationship between clients and providers, and having clear communication and understanding during the virtual visit are crucial to effective chronic disease management (Nouri et al., 2020). Unfortunately, due to their health literacy barriers, many clients cannot understand and implement the education provided to them during the visit with their healthcare provider (Batterham et al., 2016).

Intermittent pausing during in-person visits with clients creates an opportunity to observe facial expressions, gestures, or body language and is necessary for developing understanding and connection (Partida, 2007). Virtual visits are feasible, cost-effective, and appealing compared to face-to-face in-clinic visits (Robb et al., 2019). However, there is still the concern that HCPs might be missing important information (Glauser, 2020).

Health Literacy Assessment

The COVID-19 pandemic has amplified the need for a shift from physician-centered face-to-face diabetes management to client-centered teleconsultation (Banerjee et al., 2020). Even though client education through virtual visits is not new, modifications to these visits will help providers offer better education. Specifically, the integration of health literacy assessments in a virtual environment may offer unique opportunities to improve care.

Health literacy is evident in the steps that people take to manage their health (Dawkins-Moultin et al., 2016). Most health literacy evaluations emphasize reading skills instead of functional assessments such as navigation, communication, and decision-making (D'Eath et al., 2012). Easton et al. (2010) pointed out that one of the largest used and adapted health literacy tools, the Rapid Estimate of Adult Literacy in Medicine (REALM), mainly focuses on an individual's reading skill and does not assess motivation, understanding, or capability to access or use health-related information; therefore, the REALM's assessment of health literacy is closely associated with assessments of functional literacy. Consequently, individuals who score high on functional literacy are most likely to receive a high score on the existing measures of health literacy even though their actual health literacy level is low. This phenomenon is described in the "hidden population" of adults whose health literacy issues may not be detected by healthcare providers. In this instance, the hidden population refers to the individuals who can communicate and converse well in their dominant language (Easton et al., 2010).

Research shows that health literacy can be improved through health education (Cho et al., 2008; Ntiri & Stewart, 2009; Walters et al., 2020). When providing diabetes self-management education, the client's health literacy needs to be assessed and accommodated because clients with inadequate health literacy may not be able to translate the information into appropriate action (Budge & Taylor, 2020). A systematic review performed by Walters et al. (2020) revealed that health literacy interventions improve health literacy, health behaviours, and outcomes in clients at risk of health inequality. Additionally, evidence revealed associations between health literacy and medication engagement (Chima et al., 2020); therefore, there is a need for a health literacy tool that can address people's informational needs (Altin et al., 2014).

Health literacy is essential for client engagement (Coulter & Ellins, 2007). If individuals cannot acquire, process, and comprehend basic health-related information, they will not be able to perform self-management or make appropriate decisions regarding their health (Coulter & Ellins, 2007). Kim and Xie (2017) identified that "barriers to access to and use of online health information can result from the readability of content and poor usability of eHealth services. We need new health literacy screening tools to identify skills for adequate use of eHealth services" (p. 1073).

Improving health literacy is necessary for reducing health inequalities (Coulter & Ellins, 2007). It is established that lower literacy levels result in poor health outcomes and inappropriate use of healthcare services (Berkman et al., 2011). Consequently, individuals with lower health literacy are considered "heavy users" of healthcare services (Watson, 2011); therefore, using the healthcare system more frequently. Hence, there is a link between lower health literacy and the increased risk of mortality, and shorter life expectancy (Peterson et al., 2011).

Literature Review on Health Literacy Tools

Drawing from existing research and my experience as a diabetes educator, I identified the absence of a standardized health literacy tool to help healthcare providers to better understand the needs of their clients. For this reason, I conducted a literature review focused on exploring health literacy assessment tools related to diabetes management and the tools' applicability within a virtual environment. My research aimed to improve the resources available to HCPs to better understand their clients' needs in order to provide them with the appropriate level of care needed.

Several health literacy assessment tools have been developed. Health Literacy Tool Shed created an easy-to-access database of all the validated health literacy tools (Harnett, 2017). I reviewed the Health Literacy Tool Shed and noted that it contained 200 validated and reliable health literacy tools (Boston University, 2020). I found 12 tools that were specific to diabetes health literacy and were noted to be valid and reliable in a research study. I excluded six of these health literacy tools since they were optimized for specific countries and one because it was designed for adolescents only; these were not generalizable. After I performed a review and assessed the Discovery database and Google Scholar, I found one additional diabetes health literacy tool that was not noted on the Health Literacy Tool Shed (Table 1). Therefore, I added this tool to the list of diabetes health literacy tools I reviewed for a total of six tools. I then searched for the articles available regarding these six health literacy tools, and I concluded my review with a total of 23 articles regarding the six health literacy tools (Figure 1).

Figure 1

Summary of Search for Health Literacy Tools

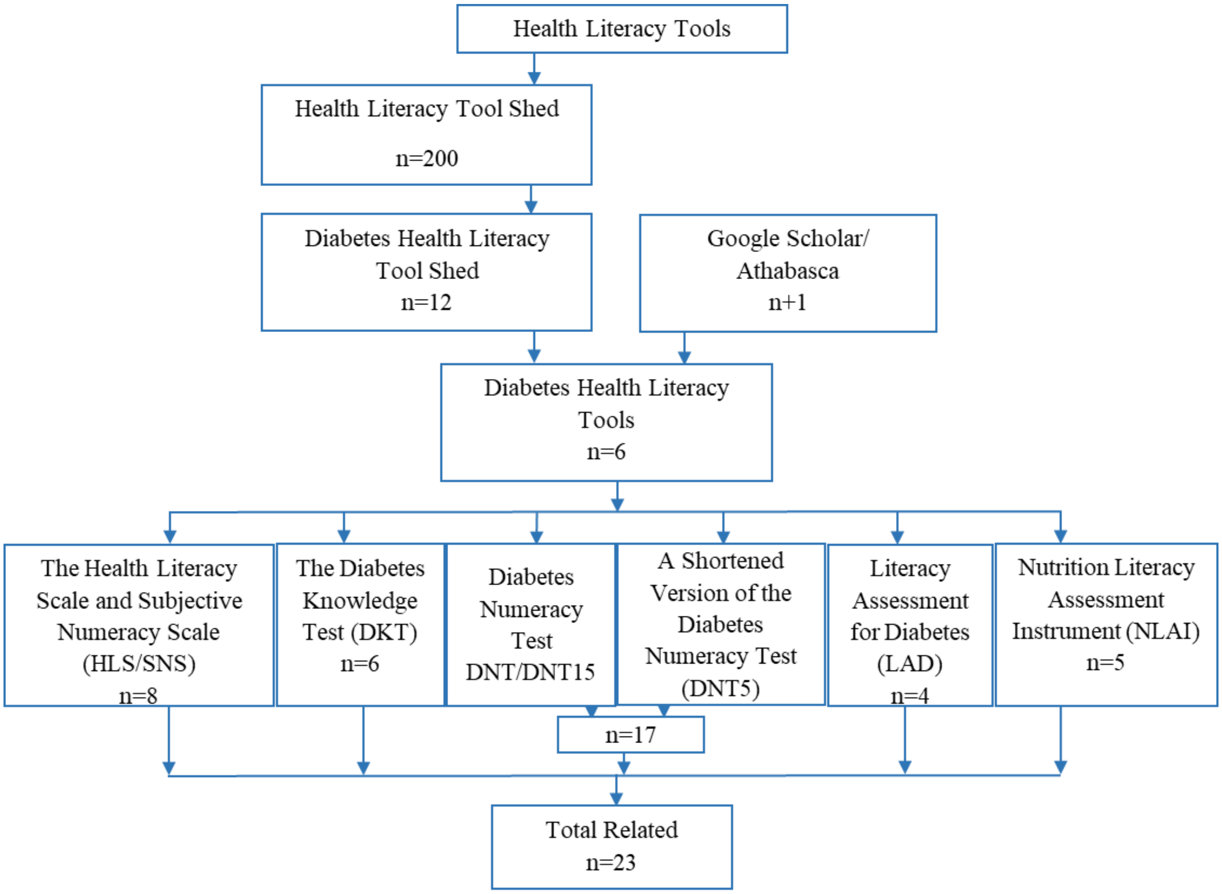


Table 1

Summary of the Health Literacy Tools

1	**The Health Literacy Scale and Subjective Numeracy Scale (HLS/SNS)**
2	**The Diabetes Knowledge Test (DKT)**
3	**Diabetes Numeracy Test (DNT)**
4	**A Shortened Version of the Diabetes Numeracy Test**
5	**Literacy Assessment for Diabetes (LAD)**
6	**Nutrition Literacy Assessment Instrument**

The following sections outline a brief overview of the selected six health literacy tools.

Composite Health Literacy Scale and Subjective Numeracy Scale

The Health Literacy Scale and Subjective Numeracy Scale (HLS/SNS) is a two-part scale where the first part (Health Literacy Scale or HLS) includes multiple-choice questions, and the second part (Subjective Numeracy Scale or SNS) includes a narrative questionnaire allowing a client to share their subjective view. When I searched for articles that included HLS/SNS, I found eight articles. Out of eight articles, three were duplications, one was not diabetes-related, and one was about Diabetes Knowledge Test (DKT). The study done by Koonce et al. (2015) included SNS and DKT as a health literacy scale and adapted educational materials for grades five and eight. The study concluded that adapting the educational materials to the clients' health literacy level will improve their diabetes knowledge. Luo et al. (2020) revealed that together, higher health and numeracy literacies resulted in higher self-management, but the SNS did not show improvement in self-management when tested individually. One study modified the HLS/SNS and incorporated a medication scale for diabetes, and concluded that in order to encourage medication adherence, health literacy and numeracy skills should both be considered when designing education materials for the client with diabetes (Nandyala et al., 2018). Additionally, Luo et al. (2018) assessed the composite HLS/SNS and concluded that the instrument is reliable and valid for measuring diabetes literacy.

Diabetes Knowledge Test

The DKT has 23 multiple-choice questions. Out of six articles that noted DKT, one was in Korean, one was a duplication of another one, and one was just a letter to the editor. The tool was deemed culturally appropriate when adapted to the specific culture (Hasan et al., 2020). When I searched for DKT-related articles, I found the study done by Koonce et al. (2015), which assessed the combination of SNS and DKT as health literacy scales and showed improvement in participants' diabetes knowledge. DKT was also assessed and modified for nursing personnel and not clients (Haugstvedt et al., 2016).

Diabetes Numeracy Test

The Diabetes Numeracy Test (DNT) is a questionnaire with 43 questions, but the DNT15 has reduced the number of questions to 15, and the DNT 5 reduced the questions to five. A few questions have multiple-choice answers, but some questions have illustrated parts such as nutrition facts (including one in the DNT5). Out of 17 articles, six were duplications, one was DNT15, one was in Chinese, and one was on adolescents only. Two articles appeared in the list of articles for DNT because the researchers adapted the literacy tools in the Arabic language (Hasan et al., 2020) and tested its validity which showed it to be a valid and reliable tool (Alghodaier et al., 2017).

The numeracy assessment is an essential tool, and the DNT is a validated and reliable tool that can be used with clients (Huizinga et al., 2008; Vacher & Chavez, 2009). DNT was noted to be stronger than the subjective tools when tested in minority clients with diabetes (Chakkalakal et al., 2017). Omar et al. (2020) performed a study about the use of WhatsApp on diabetes self-management while using DNT and found no correlation between the DNT score and diabetes improvement based on blood work results. Another study revealed that better glucose control was associated with higher DNT-15/DNT-5 scores, and lower numeracy can be a barrier to adequate diabetes management (Zaugg et al., 2014). The study performed by Bowen et al. (2013) showed that clients with lower numeracy consumed a higher percentage of calories from carbohydrates and lower percentages from protein and fat; however, the results did not show a significant difference between the dietary caloric intake in the client in the control and study groups.

A Shortened Version of the Diabetes Numeracy Test

The Shortened Version of the Diabetes Numeracy Test (DNT 15) is a questionnaire with five questions instead of the original DNT, which has 43 questions. The 15 questions are based on nutrition or carbohydrate calculation and insulin dosage calculation. When I searched specifically for the Shortened Version of the Diabetes Numeracy Test (DNT15), I found one study conducted by Turrin and Trujillo (2019), which revealed that clients with lower diabetes numeracy knowledge had higher blood glucose on average and more inadequate glycemic management.

Literacy Assessment for Diabetes

The Literacy Assessment for Diabetes (LAD) is a modified version of REALM (Rapid Estimate of Adult Literacy in Medicine) which is used to assess health literacy in diabetes; however, clients are asked only to read a series of words. Individual literacy levels are assessed based on the pronunciation of the terms. In my search, I found four articles that discussed LAD. LAD was one of the literacy tools adapted to the Arabic language (Hasan et al., 2020). The validity and reliability of LAD in seniors, prisoners, and employees of a primary care clinic were established through comparison to REALM and WRAT3 (Nath et al., 2001). Ntiri and Stewart (2009) assessed transformative learning with health literacy tools and questioned the effectiveness of using only word recognition in assessing Health Literacy. They pointed out that the pronunciation of words alone might not reflect the health literacy of the individual.

Nutrition Literacy Assessment Instrument

The Nutrition Literacy Assessment Instrument is based on a series of questions with multiple-choice answers, but some questions are based on pictures and visual images. Among five articles that I found related to the Nutrition Literacy Assessment Instrument, two were designed for only children. The developer of the tool published the three remaining articles to test, retest, and improve the tool's validity and reliability (Gibbs et al., 2018; Gibbs et al., 2017; Gibbs & Chapman-Novakofski, 2013).

Virtual Health Literacy Tools

After searching the Health Literacy Tool Shed for validated phone-based literacy tools, I found 13 health literacy tools that were available (Harnett, 2017) but none of them were specific to diabetes or any specific health condition. Health Literacy Questionnaire and eHealth Literacy Questionnaire being the most popular and universal generalized health literacy tools, contain only subjective questions (Appendix B). Eight of the health literacy tools were European-specific health literacy tools, and one was labelled as "for Asian populations" and one as "Urdu (Australia)". One of the health literacy tools is entitled Consumer Assessment of Healthcare Providers and Systems (CAHPS) which does not measure patients' understanding of the information and only measures their satisfaction with the service provided.

The Gap in Existing Health Literacy Tools

The literature review shows that several health literacy measures have been developed based on previously considered standardized health literacy tools; therefore, many of these tools have a solid connection or similarities to each other (Jordan et al., 2011). While many of these tools are based on reading comprehension, the majority have poorly defined scoring. Moreover, a tool based on reading comprehension lacks transferability and use with clients for whom English is a second language. A more comprehensive tool needs to be developed that is more practical in the clinical setting (Jordan et al., 2011). A practical tool would be short, reliable and valid, and be used by healthcare providers in any clinical setting (specialized or primary care clinics). Despite the growing research on the need for improving health literacy, a standard measure is yet to be developed in Canada to help healthcare providers better assess clients' health literacy levels, especially during virtual visits. While there is a lack of standardized national or international health literacy measurement methods or tools, many health literacy tools are available to support healthcare providers in assessing an individual's health knowledge.

To date, the majority of the research that linked low health literacy with health status has included many minority groups whose difficulties with literacy are recognizable by healthcare providers (Easton et al., 2010). Since the focus of existing research has been on visible minorities, it can create significant variances in the methods by which literacy can affect health because of the "hidden population" discussed earlier, who are not considered in the visible minorities category (Easton et al., 2010).

The Future

A diabetes health literacy assessment that is adapted for virtual visits can be used at the initiation of the first visit with the client and reassessed after education has been provided in order to see whether the client's health literacy has improved. Health literacy education can lead to health-related empowerment and personal autonomy (Grace & Bay, 2011) by allowing clients to be better engaged in their care.

The internet is a source of information for some clients; however, finding reliable information and credible sources can be challenging. Even though educational materials are available online, without health literacy it is difficult for clients to differentiate between valuable information and false information. Diabetes management is challenging because it requires education that considers a variety of factors (Meng et al., 2016). Smartphone interventions are useful in helping individuals with diabetes to perform self-management (Aminuddin et al., 2019). Readability and unsuitable usability issues interfere with the individual's ability to access online information; therefore, there is a need for a health literacy screening tool (Kim & Xie, 2017) which will allow for the adaptation of information or education based on each client's needs and health literacy level. Although mobile devices are becoming more popular, currently, the issue of access and comfort exists among older adults (Bulman et al., 2020; Gell et al., 2015) which may change in the future. If a health literacy assessment tool that can meet various needs becomes standardized, not only can it be used for virtual visits, but it can be used with individual health applications available online to adapt to clients' learning needs.

Conclusion

In summary, living with and managing diabetes requires significant effort, from monitoring blood glucose and food intake to taking the proper amount and dosage of antihyperglycemic medications. Virtual visits to receive education regarding diabetes self-management are essential but require the necessary tools to improve the delivery of education. Research reveals that health literacy is an important factor in diabetes self-management. Even if the information provided does not lead to behaviour change in clients, a healthcare provider has to ensure the client understands the information provided to them. Deciding not to follow the information is different from not understanding the information. There are many existing health literacy tools, including those specific to diabetes, but none have been used consistently in practice settings (Jordan et al., 2011) or added to the diabetes management guideline. There is a need for a tool that can be easily used in multiple methods of education provision, including face-to-face and telephone visits. Ultimately, the development and evaluation of a health literacy tool centred within a virtual environment offer the opportunity to improve the care and overall health of those living with diabetes.

Chapter 3: Theoretical Framework

This study was grounded in constructivist and pragmatic paradigms and utilized a qualitative, Quality Improvement (QI) research design to assess existing health literacy tools, and to determine their utility for use in practice by Certified Diabetes Educators (CDEs). In this chapter, I discuss the application of my philosophical assumptions, which guide the methodological approach chosen for the study.

Philosophical Assumptions

Philosophical assumptions about the nature of reality are crucial in comprehending and making sense of the research data and findings (Kivunja & Kuyini, 2017, p.27). A paradigm is a set of beliefs, or a worldview of what is considered knowledge (Guba & Lincoln, 1994; Kivunja & Kuyini, 2017). Paradigms guide researchers, their investigation, and the interpretation of findings (Guba & Lincoln, 1994; Kivunja & Kuyini, 2017; Patton, 2002).

Elements of Paradigms

While there are a number of paradigms, they are all fundamentally philosophical in nature and embrace the shared elements of ontology, epistemology, and axiology which guided my methodological approach to this research (Creswell, 2009; Lincoln et al., 2011). I approached this study from a social constructivist paradigm acknowledging that from an ontological perspective, the reality is subjective and multiple realities are constructed in my interactions with others. From an epistemological perspective, the reality is shaped by individual experiences and co-constructed between me, the researcher, and the participants who are certified diabetes educators (Creswell, 2009). As described by Kaushik and Walsh (2019), axiology is the assumption on the responsibility of morals and values in research. Researcher and participant values influence knowledge construction. I value human dignity, client-centered and client-driven care, client education which meets individual needs, and research that benefits clients.

Paradigms: Constructivism and Pragmatism

Diabetes education incorporates care and compassion as well as qualitative and quantitative evidence to support the health and well-being of individuals, families, and communities. In this research study, the main objective is to have CDEs evaluate the diabetes health literacy tools with their clients in a practice setting over the telephone. My research falls within the constructivist and pragmatic paradigms. I will further expand on my assumptions regarding these two paradigms and discuss their connection to my research study.

Constructivism.

Constructivism assumes that human beings construct their own understanding and interpretation based on their engagement with the world (Honebein, 1996), which is an essential aspect of my research study. My research question, the purpose of starting this study, and the CDEs' expert judgement on the existing tools and the development of a new tool were all embedded within the constructivist approach. Within constructivist paradigms, social constructivism aligns with my research because it views knowledge that is created by individuals (Kaushik & Walsh, 2019). Social constructivism aims to help learners to develop identity and co-develop knowledge with the focus being on human connection and learning through interaction and participation in social situations with each other and the phenomenon being investigated (Baker et al., 2022). As a way of thinking and learning, constructivism provides a framework that permits individuals to put knowledge into practice (Mvududu & Thiel-Burgess, 2012). In this research study, meaning was co-constructed between the researcher and the CDEs through multiple iterations; constructing diabetes health literacy tools (CDEs and researcher), using the tools in practice with diabetes clients (CDEs), and providing feedback through a survey and focus group (CDEs). Constructivism is recognized as a qualitative naturalistic methodology in that the research takes place in a natural environment which, in this case, is a clinical practice setting which fits well within QI studies and healthcare research. (Appleton & King, 2002).

Hoover (1969) articulated two important concepts which involve constructed knowledge which are:

1) Creation of new knowledge using the existing information and the past knowledge that effects an individual’s new knowledge;
2) Learning is an active process so individuals have to actively participate in the understanding of what they experience.

Cook (1992) mentioned that the involvement of individuals in negotiating the understanding of information and asking questions to seek the answers leads to an enriching learning experience. The understanding and negotiation involved in expanding knowledge in my research study occurred through focus groups which provided the CDE participants and me with the opportunity to gain new information and replace previous presumptions and existing knowledge. As described by Twomey Fosnot (1989), one of the principles of constructivism includes learning that occurs when individuals reconsider their old ideas and arrive at new conclusions about new ideas.

Constructivism had multiple roles in my research study:

1) Diabetes is a complex and chronic condition, and education is required to gain knowledge for diabetes self-management; furthermore, as an educator, I have to understand clients' existing knowledge and health literacy to provide further suitable education to the clients. Understanding and having used the existing diabetes health literacy tools, I saw clearly,

based on my experience, that these tools were not sufficiently applicable, and a dearth of tools for the community practice setting encouraged me to seek out further information.

2) Helping me, the researcher, to gain new knowledge through new insights received by study participants, CDEs. In turn, CDEs, drew knowledge from their past experience and current practice to evaluate the existing health literacy tools, and based on their active learning during this process, they were able to provide feedback to help the researcher to develop and modify a new literacy tool.

Pragmatism.

The three fundamental principles of the pragmatic approach are a) underlining on actionable knowledge, b) identifying the interconnectedness between experiences in practice, knowledge and action, and c) inquiry as a way of knowing (Kelly & Cordeiro, 2020). These principles demonstrate the application of the pragmatic approach in the qualitative project (Kelly & Cordeiro, 2020) and align with my research study because the aim was to have a diabetes health literacy tool that would be applicable in practice settings to help HCPs. The best method for pragmatists is the one that is most constructive in generating the anticipated results (Tashakkori et al., 1998). In this pragmatic research, I used a quality improvement approach which allowed CDEs to compare the existing health literacy tools; then, with the help from CDEs, a tool was developed and evaluations took place to assess if the tool was helpful. Finkelstein et al. (2015) explain that "pragmatic research that compares interventions to improve the organization and delivery of healthcare may overlap, in both goals and methods, with quality improvement (QI) activities" (p. 457). A research paradigm "has significant implications for every decision made in the research process, including choice of methodology and methods" (Kivunja & Kuyini, 2017, p. 26).

Pragmatic research and QI can be complementary in the implementation of research in the healthcare system (Finkelstein et al., 2015).

Quality Improvement

In their discussion of quality improvement knowledge, Perla and Perry (2011) refer to the concept of Plato's "justified true beliefs" (p. i24), or JTB, whereby knowledge exists as the intersection of belief and scientific evidence. Our belief in the value of an intervention must be aligned with evidence that supports that intervention. The methodology that best matched the study's needs in the healthcare system was Quality Improvement (QI). In QI studies, beliefs must be verified through action and together with empirical evidence to provide knowledge of what will work within local settings. At the core of this QI study was the Plan Do Study Act (PDSA), which is based on beliefs acquired through action, reflection, and learning in the clinical setting supported by evidence (Perla & Parry, 2011).

As a nurse working in the healthcare system, I have been part of QI teams that aimed to improve nursing practice and client experiences. In this study, I collaborated with CDE participants to find an appropriate health literacy tool that would improve their ability to determine each client's health literacy level during virtual visits. Given the nature of the research question, this qualitative study was situated in the paradigms discussed earlier: constructivism and pragmatism.

Conclusion

In summary, this chapter covered the philosophical assumption underpinning this qualitative research study. The paradigms were the building blocks of the study, allowing the educators to actively participate in a practice-based research project that can help them to enhance their knowledge of clients' diabetes health. I discussed the four major elements of paradigms, which are epistemology, ontology, methodology, and axiology, in connection to my research study

(Guba & Lincoln, 1994; Kivunja & Kuyini, 2017). The next chapter will discuss the study's methodology and research design.

Chapter 4: Methodology and Research Design

This chapter presents the methodology, including the research purpose, background and the role of the researcher, the qualitative study design, participant criteria and recruitment, data collection and analysis, ethical considerations, and trustworthiness.

Research Purpose and Overview

Diabetes is a health condition that presents an interesting duality as it is an intensely life-altering, yet manageable, chronic illness. Since self-care is critical in diabetes management, healthcare providers (HCPs) must design and deliver appropriate education to help empower clients in their self-management journey. To provide education that will be well understood by those with diabetes, HCPs must have an appropriate familiarity with each client's health literacy level. This can be challenging if there is no instrument or tool that can assess health literacy in the confines of the environment. The purpose of this qualitative quality improvement study was to assess the existing health literacy assessment tools and then, with the help of a team of Certified Diabetes Educators (CDEs), to either modify an existing health literacy tool or develop a new tool that could be used in a local clinical setting. The overarching goal was to identify or develop a practical tool to aid CDEs' understanding of the health literacy of clients with diabetes during virtual consultations.

Research Questions

The following are the research questions for the study.

The Main Question:

- How can HCPs’ assessment of the health literacy levels of diabetes clients be improved during virtual visits?

The Sub-Questions:

- How effective and practical are the existing health literacy assessment tools in clinical practice during virtual visits using the telephone?
- Can existing health literacy tools be improved upon or can a more effective and practical tool be developed for virtual visits with clients?

Background to the Study

Diabetes is a widespread and complex lifestyle condition that affects daily living. It is not a disease per se; therefore, a disease-centric approach to care is not appropriate. Diabetes self-management requires the active participation of individuals with this condition. Medical approaches that separate the client from the condition will not lead to success (Storni, 2015). Diabetes self-management requires clients' empowerment so they can take control of their lives and improve their health. Modern biomedical technological interventions, such as virtual visits with HCPs and telemonitoring, exist to improve clients' health. However, a client-centered approach is needed to acknowledge clients' beliefs and enable gradual knowledge transfer and client empowerment. Client empowerment can be facilitated when knowledge is recognized and appreciated, and support is provided based on individual needs rather than providing generic medical treatment and education (Anderson & Funnell, 2010; Storni, 2015).

Diabetes self-management cannot rely solely on the superiority of acknowledged experts. The individual client is both an expert in their own needs and a partner in their care. There are many ways of obtaining knowledge to perform self-management because every individual and their experiences are unique (Storni, 2015). Clients require education that is adapted to their needs; therefore, improving any chronic condition requires an understanding of the person with the chronic condition (Storni, 2015). Diabetes self-management through education is not helpful if a client does not comprehend the information that is shared with them.

There are different ways of acquiring knowledge, and due to the complexity of diabetes, two individuals living with this condition cannot necessarily be treated the same way. They cannot be expected to learn the same way because their level of education and understanding of the information being provided are different (Storni, 2015). This variation in clients' comprehension relates to how clients intake information in the clinical environment. Additionally, clients' understanding of information lies within the deeper aspect of self-management education, which may affect how they implement this knowledge. As a diabetes educator who has had a great deal of experience within both clinical and community health settings, I appreciate that empowering clients to manage their diabetes starts with assessing their health literacy levels during both virtual and face-to-face consultations.

Positionality and Role of the Researcher

Shortly after graduating from the University of Ottawa, I found my passion for diabetes education because of a strong family health history of diabetes. I am a diabetes educator and a nurse who understands the importance of education in controlling chronic conditions. I believe wholeheartedly in a client-centered approach to education and care. As an individual who grew-up in Iran in a low-income household with parents who worked very hard to meet the basic needs of their children, I can truly relate to my clients' psycho-social needs and always search for ways to improve quality of care and education. I have always been driven toward excellence and improving the quality of diabetes care. As such, I am interested in helping other HCPs to better serve the needs of diabetes clients. I view my positionality from an insider perspective because I have knowledge, experience and views regarding diabetes education and diabetes education programs in Ontario. I am also a diabetes educator working in the clinic where this study was conducted. Being an insider allows an individual to belong to that space, and therefore, the more insider the individual feels, the stronger the individual's identity with that place would be (Seamon & Sowers, 2008). Being an insider enhances the depth of understanding of the population (Dwyer & Buckle, 2009). However, it is important for me, as an individual, to identify my own beliefs and biases (Dwyer & Buckle, 2009).

I continued my learning journey to become a Canadian Certified Diabetes Educator (CDE) while working with clients with diabetes. Prior to the COVID-19 pandemic, I occasionally consulted my clients by telephone. This was especially beneficial for those who lived in rural communities and would otherwise have had to drive long distances to access the clinic. The rapid progression of the COVID-19 pandemic resulted in a significant decline in access to diabetes care in hospitals and community clinics in accordance with government mandates. Although care and education can be provided using various technologies, there are disparities in digital access among people and communities. As CDEs, my colleagues and I have interacted with our clients through virtual visits using the telephone throughout the pandemic. Furthermore, this experience convinced me that there is a need to improve HCPs' understanding of clients' health literacy levels during virtual visits so that appropriate education for self-management can be provided to clients. I believe health literacy tools should be designed to help healthcare providers to understand better clients' ability to comprehend the main aspects of diabetes management, which include knowledge regarding blood glucose monitoring, foods containing carbohydrates, and the impact of physical activity and medications on diabetes.

Research Methodology and Approach

Quality Improvement

The delivery of healthcare has become more complex, with clients requiring coordinated care due to multiple chronic conditions, and the roles of HCPs have evolved by taking into consideration multiple dimensions of quality care; therefore, the need for continuous quality improvement has increased (Hockey & Marshall, 2009). Similar to design-based implementation research (McKay, 2017), Quality Improvement (QI) is a methodology that includes collaboration between researchers and practitioners and is well suited for both qualitative and quantitative healthcare research (Shah, 2019). QI is defined as data-guided activities designed to bring about improvement in healthcare delivery in specific settings (Lynn et al., 2007). Additionally, QI is an evidence-based methodology for enhancing client care (Health Quality Ontario, 2012). While QI is often viewed as a project, it can also be research focused on practice-based inquiry (Baker, 2006; Grol et al., 2002; Speroff & O'Connor, 2004; The University of Kansas Medical Center, 2019). This QI study used a qualitative methodological approach as is described in the next section.

The QI research methodology and design in this research study focused on improving CDEs’ understanding of their clients’ health literacy levels. HCPs' involvement in quality improvement can help to advance care collaboratively and develop essential professional skills (Jones et al., 2019). The goal of QI is to improve outcomes for clients and the healthcare setting (Deming, 2018; Varkey et al., 2007). This goal aligns with diabetes education and self-management, which can help achieve positive health outcomes (Khairnar et al., 2019). The primary intent of QI is to improve healthcare delivery within a theory of what *might* work but requires further investigation (Backhouse & Ogunlayi, 2020).

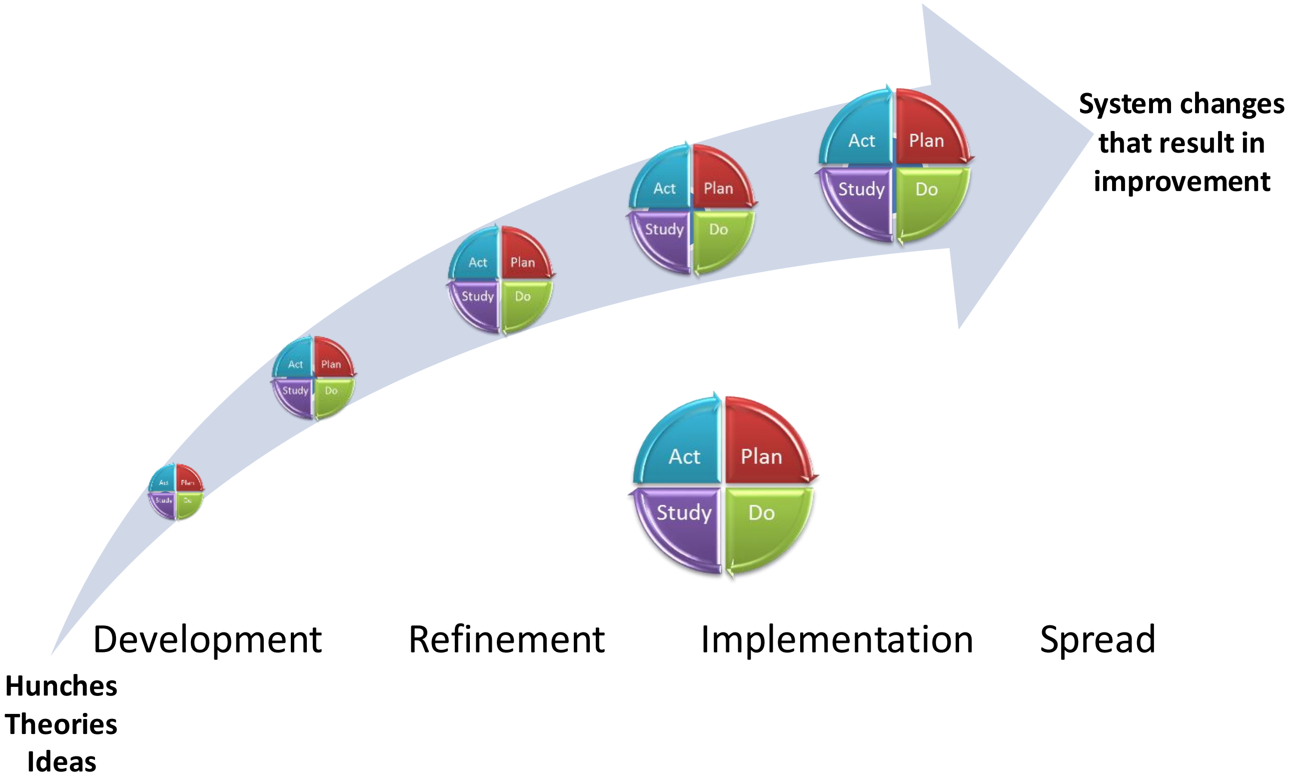
Plan-Do-Study-Act (PDSA) Model

Initiated by HCPs, QI leads to a better understanding of the complexity of healthcare delivery by using a team-based approach. The team's role is to determine the need for improvement by collecting data, assessing findings, and translating those findings into the improvement of practice (Shojania et al., 2010) and outcomes (Chawla & Suresh, 2014). A QI study includes iterative cycles of development, testing, and improvement of intervention in collaboration with stakeholders (O'Neill et al., 2011), which in this study are CDEs. The Plan-Do-Study-Act (PDSA) model provides a design that enables progressive outcomes (Hughes, 2008) (Figure 2). As a methodology aiming to improve the healthcare system for clients and HCPs (Boaden & Furnival, 2017), QI uses an adaptive and iterative design. In healthcare systems where high performance is necessary, quality improvement needs to be continuous (Boaden & Furnival, 2017; Health Quality Ontario, 2012).

Using the PDSA method in quality improvement research promotes a practice-based approach to inquiry that enables "merging of the clinical, operational, research, and educational disciplines" (Speroff & O'Connor, 2004, p.31).

Figure 2:

The PDSA Cycle (adopted from Hobbs, 2018).



The PDSA method practices a four-stage cycle approach to make changes that lead to improvement. Stage one is the “Plan” stage which involves identifying the area that needs change or improvement. Stage two is the “Do” stage which consists of testing the changes made. The third stage, which is the “Study” stage, is to assess the successfulness of the changes made. The fourth stage, which is the “Act” stage, includes identifying the adaptations needed (Taylor et al., 2014). The PDSA cycle endorses the probability of the outcome of implementing a change along with quantitative or qualitative measurements to assess the outcome of an intervention. The PDSA is primarily focused on testing the interventional experimentation of a change (Taylor et al., 2014).

Arising from issues identified in the literature review and during my practice, I aimed to address the concerns utilizing existing health literacy tools (Plan stage) by assessing the tools and either modifying an existing tool or developing a new tool suitable for the practice setting (Do stage). With CDEs as my participants and members of the research team, the effectiveness of the new tool in the practice setting was assessed by CDEs (Study stage) to find out if they were effective in order to encourage change (Act stage). Further details are provided under the section "Research Outline and Procedures". The QI qualitative approach and specifically PDSA was appropriate for this study because of its iterative design and usefulness in local practice settings, which are in need of timely improvements (Speroff & O'Connor, 2004).

It is essential to mention that I explored and considered Implementation Science (IS) as an alternative to a QI study. Lane-Fall and Fleisher (2018) emphasized that QI and IS are different fields of study with aligned goals. Similar to QI, IS is practice-based, has been identified as a way to bridge the gap between research and practice, and aims to identify barriers facing individuals, groups, or organizations (Bauer & Kirchner, 2020). Additionally, IS intends to develop and apply strategies to overcome barriers and promote evidence-based clinical innovations (Bauer & Kirchner, 2020). While QI focuses “on creating more timely local change”, IS is concerned with “creating more explicitly theory-based generalizable knowledge that necessarily proceeds more slowly” (Lane-Fall & Fleisher, 2018, p. xiii). Since my intervention was the development of a health literacy tool for use in practice in a local setting, I deemed that QI was a reasonable choice and is aligned with my epistemology, ontology, and research questions. While IS was beyond the scope of my study, I will consider its benefits for future research.

Research Design

As a nurse and CDE, the qualitative approach gave me more flexibility to explore and understand how a diabetes health literacy tool could be improved. A qualitative approach emphasizes participants' voices and allows for knowledge sharing and new knowledge construction (Auerbach & Silverstein, 2003). QI methodology allows for collaboration between the researcher and the participants, who are also stakeholders. This study enabled the CDE participants to provide their interpretation of the usefulness of selected diabetes health literacy tools found in the literature. Additionally, CDEs were able to share their view of the new tool that was developed based upon their expert knowledge and input. In the next section, I will discuss the multiple phases of this study in more detail.

Research Location and Participants

Research Location

The research was done through the Community Diabetes Education Program Ottawa (CDEPO), an Ottawa-based program that provides education to clients with diabetes. CDEPO provides individual and group programming to adults with diabetes and prediabetes to help them manage their diabetes, live healthy, and avoid complications. Currently, all Registered Nurses (RNs) and Registered Dietitians (RDs) on their staff are also Certified Diabetes Educators. The CDEPO program focuses on promoting self-care behaviours that can help people achieve targets for staying healthy. Additionally, CDEPO is one of the largest community diabetes education programs in the province, providing services at nine different locations across Ottawa with teams based out of both Community Health Centres and Community Resource Centres. CDEPO is part of a network of diabetes programs in Ottawa and shares resources with other members of these networks. While CDEPO's educators have met clients through varied modalities in the past, including in-person individual appointments, in-person group appointments, virtual visits by phone and virtual visits through video conferencing platforms, pandemic restrictions forced an emphasis on virtual care provision. It is important to note that the CDEs' visits with clients were done via phone as the study was based on a distance model of education in providing virtual care.

Research Participants

With permission from the CDEPO manager to conduct my study in the program's clinical setting, four CDEs were selected to participate in the study. These CDEs were selected based on the convenience sampling, their experiences, expertise in CDEPO as well as their availability. However, due to unforeseen changes in the staffing, only three CDEs could participate to avoid disruption to the day-to-day responsibilities of CDEPO. CDEs' participation was voluntary, and written consent was received prior to them joining the research study. CDEs had already passed the Canadian Diabetes Educators Certification Board (CDECB) exam, and they have worked with clients at various stages of diabetes management.

The clients, who were assessed by CDEs, were all above 18 years of age, and they were referred to CDEPO by their family physician, pharmacist, other HCPs, or through self-referral. The new tool, which was developed in the study, was used as a first-line assessment for CDEs to better understand the health literacy of their clients, which would allow them to provide appropriate diabetes education. CDEs' participation was voluntary, and written consent was received prior to them joining the research study. Since the study was done virtually, I emailed the consent forms to CDEs, and they had the opportunity to review, sign and email them back to me.

Research Outline and Procedure

This research study involved the completion of five phases which are described in detail and summarized in Table 2.

Phase One of the Study

In phase one, I conducted a literature review, during which I searched for existing and available health literacy tools. As discussed in chapter two, I reviewed all health literacy tools, and then I narrowed my search to diabetes health literacy tools available in the English language for adults with diabetes, which left just six tools. Then, I conducted a further review of these six validated tools (Appendix B). These tools consisted of surveys, open-ended questions, and pronunciation of diabetes related terms. Upon the recommendation of the members of my supervisory committee and considering CDEs' time constraints, I selected the three most appropriate diabetes health literacy tools to be reviewed by the three CDEs. While many of these tools were based on reading comprehension, the majority had poorly defined scoring in assessing health literacy (Jordan et al., 2011). A practical tool should be short and can be used by HCPs in any clinical setting, including telehealth in specialized or primary care clinics. Therefore, the top three of these six tools were selected based on the following criteria.

- Covered diabetes knowledge most thoroughly by assessing understanding of clients' knowledge regarding diagnostic testing and hypoglycemia treatment
- Included information regarding blood glucose monitoring, understanding carbohydrates, and the impact of physical activity and medications on diabetes
- Were appropriate for use over the phone and did not contain pictures or require clients to look at the imagery or words in order to respond to the questions

Phase Two of the Study

The purpose of phase two was to collect and summarize the CDEs' feedback about the applicability of the three tools in the clinical setting. I sent the three CDEs an individual email of invitation (Appendix C) asking them to participate in the study, and I requested their consent and agreement (Appendix D). Once I received their signed consent and agreement electronically, I emailed each CDE a few questions (the contents of the email will be shared in Chapter 5 and Appendix E) and instruction for their initial focus group participation (Appendix E). I invited them to send me a written summary of their comments prior to the initial focus group. Participation in the focus group allowed the CDEs to share their feedback openly within the group.

Based on the CDEs' feedback, none of the tools were favourable in clinical practice. The effectiveness of the health literacy tools was evaluated based on the CDEs' assessment of the tools. The three CDEs shared a common perception of the existing tools that they were either too long or too complex and were not useful in the practice setting to help them to better understand their clients. Therefore, they suggested the development of a new tool that would incorporate the client's existing knowledge of diabetes, and it would be simple, short and specifically designed so that the tool could be used during a phone visit. The data collection is elaborated later in this chapter.

Phase Three of the Study

The purpose of phase three was to develop a new diabetes health literacy tool. As diabetes is a broadly defined condition and a complex etiology, the diabetes health literacy tool is needed to capture clients' understanding of critical factors related to their diabetes management. These key factors are blood glucose, medication/insulin, hypoglycemia, and diet/nutrition (Diabetes Canada, 2019). A major priority was assessing each client’s understanding of proper and adequate recognition, treatment, and prevention of low blood glucose levels, known as hypoglycemia, in order to prevent potential arrhythmia, coma, or death, as well as impaired driving (Yale et al., 2018). Therefore, this study focused on creating a health literacy tool that captured these essential aspects of diabetes self-management. The questions that arose for different parts of the research were as follows:

- How can HCPs’ assessment of the health literacy levels of diabetes clients be improved during virtual visits?
- How effective and practical are the existing health literacy assessment tools in clinical practice during virtual visits using the telephone?
- Can existing health literacy tools be improved, or can a more effective and practical tool be developed?

Based on the comments received from the CDEs at the initial focus group in phase 2 regarding the characteristics of an ideal tool in the practice setting (discussed in further detail in the next chapter), I developed a new health literacy tool. Then, I shared the draft tool with the

CDEs, allowing them to review and revise the tool multiple times to ensure it accurately represents their vision while considering the bio-psycho-social and spiritual needs of their clients. The new diabetes health literacy tool was specific for diabetes health literacy, and according to the CDEs, it was deemed useable and practical to implement in the practice setting.

Phase Four of the Study

The purpose of phase four was to implement the new diabetes health literacy tool in the practice setting. Once the new tool was developed in phase three, the CDEs then used the tool during the initial visit with their clients to assess their clients' health literacy. Since the new tool was developed to help HCPs to better understand their clients' health literacy levels, it was evaluated by CDEs in this phase of the study. The three CDEs used telephone visits (virtual visits) which was the existing clinical practice at the Community Diabetes Education Program of Ottawa (CDEPO). The use of a health literacy assessment tool is not a part of current practice; therefore, in my study, the CDEs consistently used the new health literacy tool during their initial visit with their clients. After five and a half weeks of CDEs using the tool, I administered a qualitative survey to assess the CDEs' evaluation and perception of the tool.

Phase Five of the Study

The purpose of phase five was to collect and summarize the CDEs’ feedback about the applicability of the new diabetes health literacy tool in the clinic setting. I developed a qualitative survey with eight questions to better understand the CDEs' view of the new health literacy tool and its effectiveness in helping them better understand their clients. Since the questions in the health literacy tool included objective and subjective questions, the questions in the survey were specific in order to capture the enriched information. The first two questions in the tool were demographic questions about their age and profession. However, the rest of the questions were regarding the assessment of the new diabetes health literacy tool, and the Likert Scale was utilized (Appendix F). In addition to the qualitative survey, I organized a final focus group to collect information from the same CDEs in order to determine the tool's usefulness in practice. Qualitative data were collected during the final focus group session. Figure 3 depicts the five phases of the research. Additionally, in order to obtain a new perspective, I asked a different CDE, who was not part of the creation and testing of the tool, to evaluate the tool. She provided a summary of her view on the appropriateness and applicability of the tool in the practice setting.

Table 2:

Five Phases of the Study

Phase	**Task**	**Individuals Involved**
Phase 1: Literature Review	Conducted literature review and searched for existing health literacy tools. The literature review was revisited and expanded during the course of the study.	Researcher
Phase 2: Data Collection	Determined the applicability of the three existing tools in practice with the CDE participants during an **initial focus group.** The CDEs were provided with a copy of the tools in advance to provide their expert opinion.	Three CDEs from Ottawa, Canada
Phase 3: Data Collection	Developed a new health literacy tool based upon some features of the existing tools.	The researcher developed the tool with the help from 3 CDEs who also assessed the new tool.
Phase 4: Data Collection	CDEs used the tool to evaluate clients' health literacy over the telephone. After five and a half weeks of CDEs using the tool, I administered a qualitative survey to CDEs who used the tool.	Researcher and 3 CDEs
Phase 5: Data Collection	At the **final focus group**, CDEs shared about their experiences with using the new health literacy tool with their new clients during the virtual visit in the practice setting.	Researcher and 3 CDEs

Figure 3:

Summary of Research Development Process

Data Collection

Four sets of qualitative data were collected throughout the research study. As discussed in Chapter 2, multiple health literacy tools exist; however, these tools have not been used in general practice settings due to their lengthiness and questionable validity (Altin et al., 2014).

First Round of Data Collection

The first round of data was collected during phase two. I provided the CDEs with the three existing health literacy tools as per the selection criteria discussed earlier. Then, I asked the CDEs to independently assess each of the existing tools by reviewing them, comparing them, and considering their practicality in a clinical setting. In order to minimize bias, I did not provide the CDEs with my own perceptions of the currently existing tools. The CDEs then provided a narrative assessment of each tool by sharing their perceptions in a non-structured method to capture their informed assessment during the focus group. Following this, I drafted a new tool based on the information received from the literature review, the CDEs' expert opinions on the existing tool, and my knowledge and experiences as a CDE. My knowledge as a CDE was helpful in understanding diabetes and knowing the terminology in capturing the educators' thoughts and ideas in an appropriate way.

Second Round of Data Collection

The second round of data collection took place in phase three, after the first draft of the new diabetes health literacy tool was developed and reviewed independently by the three CDEs. Based on the assessment, comments, and suggestions that they provided, the tool was improved.

Third Round of Data Collection

The third round of data collection took place at the end of phase four. The CDEs (three) who implemented the new diabetes health literacy tool with their clients during telephone-based virtual visits were asked to complete a survey (Appendix F) to better assess their perspectives on the use of the tool and whether or not it was helpful in the virtual practice setting.

Fourth Round of Data Collection

The fourth round of data collection took place during phase five. The CDEs (three) who used the tool with their clients during telephone-based virtual visits and completed the survey in round three were asked to participate in a final focus group session in order to gain a more in-depth understanding of their perspectives on the use of the tool and whether or not it was helpful in the virtual practice setting.

Qualitative Data Analysis

The strategy that I used for analyzing the qualitative data was thematic analysis, which is a method of analyzing and organizing the data based on various themes to make sense of that data (Braun & Clarke, 2006; Braun & Clarke, 2012). Thematic analysis can help researchers to work with small or large qualitative data to make sense of them through patterns of meaning or themes (Clarke et al., 2015). The patterns of meaning can help researchers to recognize and make sense of the information, even in small data sets. The thematic analysis allows the researcher to systematically organize the data by focusing on meaning across data sets (Braun &

Clarke, 2012). As Novell et al. (2017) revealed, there are advantages to thematic analysis, such as its flexibility to meet the need of the study as well as its usefulness in exploring the perspectives of the study participants while finding similarities and differences, and sometimes producing unexpected insights. I believe that having a meaningful analysis of the emerging themes is vital to understanding the applicability of the existing health literacy tools in a practice setting.

One of the important features of the thematic analysis is the researcher's ability to distinguish between a meaningful theme and an irrelevant theme (Braun & Clarke, 2012). Braun and Clarke (2006) discussed that thematic analysis is a crucial method for qualitative research, and it should be the first method of analysis that qualitative researchers should learn about. The thematic analysis is flexible and maintains the richness of data but still allows for the interpretation of the data set (Braun & Clarke, 2006). Therefore, I believe that the thematic analysis aligned well with the QI methodology in my research study. I used the thematic analysis in both focus groups (initial and final focus groups). The recurrent themes helped me to better categorize the findings.

Resource Requirements

Since this research was primarily based at CDEPO, which is a provincially funded program and is part of the Centretown Community Health Centre, the CDEs were already employed by the CDEPO program. CDEPO and its staff were open to participating in this study and did not require any nominal honorarium since the staff have always been encouraged to participate in quality improvement initiatives and be part of various committees. Client care was not negatively affected as regardless of participation, clients received accurate information regarding diabetes self-management from the CDEs. The CDEPO virtual visit platform, which was Zoom, was used for focus group purposes. The CDEs were using the existing telephone system for calling clients. If there was an Information Technology (IT) support required for electronic information retrieval, the CDEPO IT staff were able to provide the support at no additional cost as the staff was already employed by CDEPO. In the future, I will apply for funding through Athabasca University for the costs associated with my participation in conferences for learning and advancement as well as for disseminating the knowledge gained.

Time Allocation

The estimated time allocation for this study was summarized in Table 2, which was presented earlier in this chapter. Phase two and three of the research study, which was the assessment of existing tools and development of the new tool, and receiving initial feedback from the CDEs, were done in the first two-three weeks of the study as the CDEs showed eagerness to join the study and were very flexible in dedicating their time and effort to the study. Phase four was five weeks, and during that period the CDEs used the new tool that was developed in the practice setting and completed the survey. Finally, phase five of the study, which was the final focus group to assess the CDEs' feedback, was conducted right after the survey to ensure the CDEs were able to recall the information accurately.

Ethical Considerations

QI studies are intrinsic to healthcare professional practice (Lynn et al., 2007). Knowledge seeking that improves clinical practice is integral to healthcare and is mandated as a part of professional practice. It is anticipated that QI studies provide no increased risk to patients. (Ottawa Health Science Network Research Ethics Board, 2016); however, The Ottawa Health Science Network Research Ethics Board (OHSN-REB) indicates that quality improvement projects that involve research may need research ethics board approval (OHSN-REB, n.d.). Any potential for harm must be prudently considered and mitigated (Government of Canada, 2019). I sought further information from the OHSN-REB. This study required consideration by Athabasca University's Research Ethics Committee. The Certification of Ethics Approval was received and shared with CDEPO prior to starting the research study (Appendix A).

Other considerations and measures I took in this study are described as follows.

- Because voluntary and informed consent are crucial to all research involving humans (Connelly, 2014), I asked the CDEs to voluntarily participate in the research study and provide their informed consent in writing.
- There was no power differential between the participants and the researcher, as we have the same CDE designation and role as diabetes educators. I also assured them that their data would be collected and stored anonymously and they could decline participation at any stage of the study
- The CDEs shared their views anonymously in phase four via a survey through Survey Monkey (Appendix G). I ensured that each participant removed their name and turned off their video when they participated in the focus group sessions. As CDEs working in the same program, these participants knew each other. However, I respected their anonymity when providing the survey results and when sharing findings.
- I saved the information and comments shared by the CDEs during the two focus group sessions on a personal encrypted, password-protected USB to ensure the participants' data were protected. Data were stored without the name, date of birth, or other specific identifying information.

- When the data was presented, complete anonymity was used to protect the confidentiality of the participants.
- In order to ensure the interviewees' comments and assessments were presented accurately, each participant was given the option of reviewing the summary of the results that emerged from my data analysis. I submitted this summary to each CDEs via individual email, and received confirmation of accuracy from the CDEs.

Trustworthiness

It is noteworthy to mention that the research was done using a qualitative approach, which is subjective in nature; therefore, bias comes into play. Throughout the course of this study, I identified and reflected on my preconceptions and biases; however, my participants are my equals and possess much knowledge and experience gained from their combined years of work in diabetes care and management. “Local knowledge, perhaps not generalizable, is still reliable and valid and can serve as a guide to action, learning and improvement” (Perla & Parry, 2011, i26), which are core elements in QI studies. According to Health Literacy Tool Shed, the selected tools have been validated by researchers (Harnett, 2017), but because this study is qualitative, I chose trustworthiness over validity and reliability. The credibility of the assessments was related to the expertise of the assessors. In terms of expertise, the CDEs had the educational and experiential background to provide a credible assessment with multiple years of experience in their roles as CDE.

Lincoln and Guba (1985) argue that trustworthiness involves the establishment of credibility, dependability, confirmability, and transferability. I assessed the credibility by ensuring that I stayed true to the information I received from the CDEs and presented accurate information shared by the participants' data. I performed member checking to ensure the accuracy of the information I collected. Additionally, the health literacy tool's credibility was assessed in the final focus group that was done after the research was implemented to determine the participants' views and areas for improvement based on their experience in practice.

The dependability of my study was optimized by ensuring that the findings were consistent and that I did not make any mistakes when conceptualizing the study, collecting the data, interpreting the findings, or reporting the results. I presented the detailed information shared by all participants in order to ensure the explicit feedback that each CDE provided was captured and evident. Confirmability, which is the degree of neutrality, is based on the researcher’s objectivity. Therefore, during the final focus groups or survey, I did not share my personal perspectives on iterations of the health literacy tool with other CDEs to mitigate bias, motivation, or interest (Forero et al., 2018). I asked them to expand on their perceptions to ensure I understood captured their feedback clearly, but I did not offer my opinions. As a CDE, I have experience regarding diabetes management, which came to be helpful when compiling the information provided by the educators and making sense of them and developing the first draft of the new diabetes health literacy tool based on CDEs’ requests.

CDEs were asked to use the tool with clients with type 2 diabetes, but mistakenly, CDEs used it when interacting with their clients who had type 1 and prediabetes as well. At the end of the research, the transferability of the tool was unexpectedly assessed by the CDEs when they used the tool in their virtual visits with clients with various types of diabetes, and they suggested that the tool can be used with other types of diabetes with further modifications. However, further study needs to be done in order to determine if the results of the study can be replicated in other diabetes programs in addition to CDEPO. Since the tool was specifically designed for clients with diabetes, it will not be transferrable to other chronic conditions. Nevertheless, since it has shown to be useful, with further modification as per the CDEs' final recommendations, the tool has the potential to be used in future studies as a template to better understand the health literacy of clients with diabetes or other chronic conditions.

Scope of the Study

As the research was primarily done in Ottawa, as CDEPO is an Ottawa-based program, the clients involved in the study were from Ottawa and the surrounding areas. The health literacy tool was developed only in English and was not used with individuals who had language barriers, nor was their use of phone interpreters because of the risk of misinterpretation.

Currently, multiple health literacy tools exist, but as mentioned earlier, they have not been used in many studies. Additionally, the existing tools are very broad and not specific to the scope of practice, such as diabetes, heart disease, etc. However, the tool that I developed in my research study provided specificity to diabetes and was feasible to be implemented in a practice setting. Cumbie et al. (2004) noted that chronic illness management requires personalized care to the clients' bio-psycho-social and spiritual needs to empower them through long-term self-management of their condition. Therefore, self-management requires time and effort from both the clients' and the HCPs' perspectives.

Conclusion

In this chapter, I presented the methodology for my research. I included the background and the role of the researcher, the qualitative study design, participant criteria and recruitment, data collection analysis, ethical considerations, and trustworthiness. I provided detailed information along with a table and figure that summarized my research process (Table 2, Figure 2).

Chapter 5: Findings

This study aimed to assess the existing diabetes health literacy tools to find an appropriate tool that can help Certified Diabetes Educators (CDEs) to better understand the health literacy of their clients and provide them with appropriate education in virtual visits optimized for the client's level of understanding. In this chapter, I provide the results of the study without any interpretation to ensure that the actual findings are clearly presented. The interpretation of the study will be further explored in the following discussion chapter.

Phase One

Phase one of the study included the search for the existing health literacy tools using literature review. This review helped me to better understand the breadth and depth of already available health literacy assessment tools. During this search, I found six health literacy tools that were specific to adult diabetes and presented in the English language (Table 3). Then, I completed a search for each individual tool. Chapter 2 provides a detailed account of each of the six instruments.

Table 3

List of the Health Literacy Tools

1	The Health Literacy Scale and Subjective Numeracy Scale (HLS/SNS)
2	The Diabetes Knowledge Test (DKT)
3	Diabetes Numeracy Test (DNT)
4	A Shortened Version of the Diabetes Numeracy Test
5	Literacy Assessment for Diabetes (LAD)
6	Nutrition Literacy Assessment Instrument

Phase Two

In this phase, the tools I located in phase one were evaluated for applicability in practice in the unique clinical environment of diabetes self-management education for adults. I reviewed the six tools in detail and found the following gaps:

- The tools were not necessarily assessing health literacy but more so the reading comprehension of individuals (Jordan et al., 2011).
- The majority of the tools had poorly defined scoring (Jordan et al., 2011).
- The existing health literacy tools mainly focus on minority people and do not adequately consider the rest of the population (Easton et al., 2010).

Based on the further review of each tool and the recommendation from my supervisory committee members to select three of the six tools for review by the CDEs, I narrowed the list to three of the existing diabetes health literacy tools using the criteria discussed in the previous chapter. I assessed the appropriateness and practicality of the tools in the specific practice setting based on the existing literature. The three tools were the Diabetes Knowledge Test, the Diabetes Numeracy Test 5, and the Health Literacy Scale-Subjective Numeracy Scale. The following is a brief description of each of the three tools that I selected for use in the QI study.

The Diabetes Knowledge Test is a test with twenty-three questions with multiple-choice answers; therefore, it can be easily used in the practice setting. The tool includes key questions related to low blood glucose levels (hypoglycemia) to assess clients' understanding of hypoglycemia and its treatment. This test also incorporates questions about various aspects of diabetes management.

The Diabetes Numeracy Test 5 is one of the three Diabetes Numeracy Tests in the literature. The Diabetes Numeracy Test 5 is the shortest version of the original one, the Diabetes

Numeracy Test, which contains forty-three questions. Therefore, the Diabetes Numeracy Test 5, which only has five questions, is better suited for use in practice settings, especially over the phone.

I selected the Health Literacy Scale-Subjective Numeracy Scale (HLS-SNS) because of its broader content conception and the inclusion of both objective and subjective assessment components.

I shared the aforementioned three health literacy tools with the CDEs in separate emails prior to organizing the initial focus group.

Email Assessment Prior to Initial Focus Group

The three health literacy tools were shared with CDEs along with three open-ended questions to provoke and capture the educators' thoughts on each one prior to the initial focus group. The questions were:

- What are your thoughts on the existing health literacy tools?
- What are the pros and cons of the tools?
- Would you be able to use any of the tools in your practice setting? Which ones? Why?

Each of the three CDEs (CDE 1, CDE 2, CDE 3) answered the questions separately and submitted their responses back to me via email; she did not know who else was participating in the study, so their answers were unaffected by the answers provided by their peers (Table 4).

Overview of Email Responses of the CDEs.

CDE 1 wrote that the HLS-SNS tool is both simple and challenging because it includes objective and subjective questions and requires more self-reflection, and the questions are “harder to answer". The Diabetes Numeracy Test 5 is a questionnaire that starts with simple questions, and then the subsequent questions become more complex and complicated. The Diabetes Knowledge

Test questions require some knowledge of diabetes and diabetes education. However, some of the questions include personal/cultural biases, and other questions apply to the client concerning medications or using a blood glucose meter. CDE 1 mentioned that the HLS-SNS would help to guide the educator on how to best serve the client, the Diabetes Numeracy Test 5 would be helpful to understand if the client is able to implement a task, and the Diabetes Knowledge Test would be useful to test the client's understanding of the provided information. However, CDE 1 found the HLS-SNS and Diabetes Knowledge Test to be long and can be intimidating to clients, while the Diabetes Numeracy Test 5 is short and less intimidating. CDE 1 also felt that it was possible to use the Diabetes Numeracy Test 5 when doing phone visits with clients.

CDE 2 found the HLS-SNS tool challenging to read and understand. She mentioned that the Diabetes Numeracy Test 5 was easier for clients to understand, but there were still some very difficult questions involved that would require aiding the client to complete this tool. This CDE found the Diabetes Knowledge Test to be the easiest tool overall because of its descriptive nature but did not feel it was appropriate for all clients since it includes questions about insulin use which could alienate those on different medication regimes. While open to using the Diabetes Numeracy Test 5 and the Diabetes Knowledge Test, this educator felt that the Diabetes Numeracy Test 5 might be easier to use.

CDE 3 mentioned that none of the tools considered the average grade level from a literacy perspective and found most of the tools very lengthy or more advanced. She noted that the HLS-SNS tool is complex, assumes that people can read English, and there is no option for choosing "none of the above". This educator found the Diabetes Numeracy Test 5 to be simple but not feasible for use over the phone considering the length of the questions and details and noted that it would be too challenging for new clients. CDE 3 further felt that the Diabetes Knowledge Test includes some simple questions, but it is exceptionally long, and some questions are too complex. While this educator said that she would not mind using the shorter version of the Diabetes Knowledge Test, she did not believe that any of the existing tools were appropriate for use in the practice setting. The verbatim responses by the three CDEs are reported in Table 4.

Table 4

Verbatim Email Responses of CDEs

Questions	CDE 1	CDE 2	CDE 3
What are your thoughts on the existing health literacy tools?	Regarding HLS questionnaire: 1. Health Functional literacy- this is simple to answer. Usually, a yes or no answer 2. [Communication] Health Literacy – this requires more self-reflecting and harder to answer 3. Critically Healthy Literacy – more difficult than the last and of course requires more time investment and someone to understand what they are doing and looking for I see the literacy level increases from health, to [communication] to critically literacy. Therefore, the level of education one obtained reflects the answer one would receive. 4. Subjective numeracy scale – just like the title. It is subjective. This provides an understanding of what the client understands best and their level of education. Regarding: DNT5 Question #1: simple and easy to answer Question #2: more complicated than the first due to fractions Question #3: can be very complicated both in term of doing the fractions and also in giving the answer. For example, exact answer is 1 and 1/5 crackers.	HLS – found this difficult to read/understand so possible that clients may find the questions confusing. DNT5 – This one may be easier for client's to understand but some questions very difficult and I think clients would need a lot of coaching to complete this tool. Questions may apply better to all types of clients. DKT - because questions are more descriptive and also related to diabetes, clients may find this tool easiest to complete out of the 3 tools. Since everyone’s diabetes is different, some client’s may not be able to answer some of the questions only due to not learning this information yet. For example there	None appear to be considering average grade level for words used (in terms of complexity), most are very lengthy or too advanced. I wish there was a 5-10 question tool with simple questions that could assess if client prefers written or pictures resources, their current understand of diabetes and how they learn best.

	Question #4. Answer to question can be easily guessed as it is multiple-choice Question #5. This assume client would understand what is round down and whole number would be and ability to divide. Regarding: DKT Overall, questions required some knowledge of diabetes and diabetes education. Question 2—I question personal/cultural bias Q-4: I cannot even answer Last few questions. Applies to client who received diabetes education and on AHA/insulin and check BG.	are questions about insulin but this tool would be used for all new clients and some may not understand anything about insulin.	
What are the pros and cons of the tools?	Choosing/creating the literacy tools would be based on your intent: i.e. general knowledge or being able to take correct dose of insulin. I find the HLS questionnaire helps me understand how I can best service my client. The DNT5 questionnaire would help me understand if client is able to implement the task. The DKT questionnaires would be helpful to test their understanding. The HLS and DKT questionnaires are long; whereas the DNT5 is much shorter and less intimidating. DKT can be very intimidating. Sometime we know the correct answer but choose wrongly because we questioned ourselves. DNT5's level of complexity increases. It gets harder; therefore one can assess client's ability to do the math and understand the question.	Some pros/cons mentioned in above answer.	HLS & SNS-8 – Pros: None, Cons: complex words for a lot of clients, it assumes people can read English (first question), no option for “none of the above”. DNT 5 – Pros: Simple. Cons: Not sure how this would be done over the phone given the length of the questions and details (i.e. nutrition facts), 4/5 related to diet, feels like a test for DM1 for pump approval, too challenging for new clients. Diabetes Knowledge test – Pros: Some questions are simple and I believe will help understand client's health literacy (such as questions about what is the A1C, possible

			complications of diabetes…", multiple-choice question. Cons: +++ Lengthy will take too much appt time and client will be irritated, some questions are too complex (i.e. DKA)
Would you be able to use any of the tools in your practice setting? Which ones? Why?	I can see myself using the DNT5-quick and easy.	Yes, I would use DNT5 and DKT, I think clients would find DKT easier to answer as questions more descriptive, but DNT5 may give better literacy results.	I believe a shorter version of the Diabetes Knowledge test would be applicable to my practice but otherwise none at this time either d/t length or complexity of them.

Initial Focus Group

The initial focus group took place after each CDE responded to the questions listed in emails sent to them previously. During the focus group, I invited the CDEs to expand on their responses to previous questions. Additional guiding questions and topics to stimulate discussion included pros and cons regarding the three diabetes health literacy tools reviewed, whether any of the tools would be ideal for use in their practice setting, and what an ideal tool looks like to you (see Table 5). I recorded the focus group with permission from CDEs, and took notes. I transcribed the recorded information shortly after to ensure the details were captured accurately.

Summary of Responses Regarding Pros and Cons of the Existing Tools.

The educators each provided their views on the cons and pros of the three tools (Table 5).

- The Diabetes Knowledge Test: On the positive side, the tool is multiple-choice and descriptive. However, two of the three educators perceived the Diabetes Knowledge Test as too long and the questions too advanced or challenging for clients to answer.

- The Diabetes Numeracy Test 5: The positive points raised were the length of the tool, which is short and therefore not time-consuming; therefore, it was seen as more realistic for use with clients. The negative points made by CDEs were that the tool is challenging and math-based, and one educator noted that the clients would need a calculator to complete the answers. The CDEs stated that it represented an advanced level of diabetes management as it included carbohydrate counting, which is not mandatory for all clients to master for their diabetes management, unless they are on multiple daily insulin injection regimes that require counting carbohydrates in order to calculate the dosage of insulin needed to inject at the meal.
- The Health Literacy Scale and the Subjective Numeracy Scale: Only one CDE remarked positively about the Health Literacy Scale and the Subjective Numeracy Scale tool, which was easy to use. However, most responses were largely negative. One CDE mentioned that she disliked the tool. All CDEs suggested that the instrument was confusing, and it was unclear with complex words and assumed that individuals could read. One CDE mentioned that it is subjective and there is no way to verify the answer. Another CDE noted that it requires clients to have math skills.

Table 5

Pros and Cons of Existing Tools: Verbatim Responses of CDEs

Tools	CDE 1	CDE 2	CDE 3
Diabetes Knowledge Test - Pros		-Descriptive -Multiple-choice	-Descriptive
Diabetes Knowledge Test - Cons	-It feels like writing an exam. -Difficult to do over the phone. -Client will lose concentration.	-Questions are advanced. -Client who are not on insulin might not understand the question.	-Too long for a phone visit. -Questions are advanced.
Diabetes Numeracy Test 5 - Pros	-Fast	-Shorter	-Short -More realistic for clients to complete. -Being only 5 questions were good.
Diabetes Numeracy Test 5 - Cons	-As the questions become difficult after 2-3 questions. -Some of the questions are for people who are on insulin and carbohydrate counting. -Hard to do it over the phone. -Client needs to know math and needs a calculator.	-Questions are very difficult and clients will feel frustrated to answer them. -Hard to talk about nutrition fact over the phone. -It is math-based.	-It feels like an exam: challenging. -Her initial thought it was test for type 1. -Reading nutrition fact over the phone is not possible. -The health literacy supposed to be more basic. -It is all about math.
Health Literacy Scale and the Subjective Numeracy Scale - Pros	-The questions are easy to ask.		
Health Literacy Scale and the Subjective Numeracy Scale - Cons	-Very subjective, they can say yes or no but there is no way to verify that they are telling the truth. -The words are complex.	-Confusing and difficult -Not clear	-Hate it -It assumes that people can read - makes them feel bad. -The words are very complex. -Very lengthy and not feasible for phone assessment. -You have no option of none of the above so you have choose. -For the numeracy scale part again, client's ability to do math.

Summary of Responses on Use of Existing Tools in Their Practice Setting.

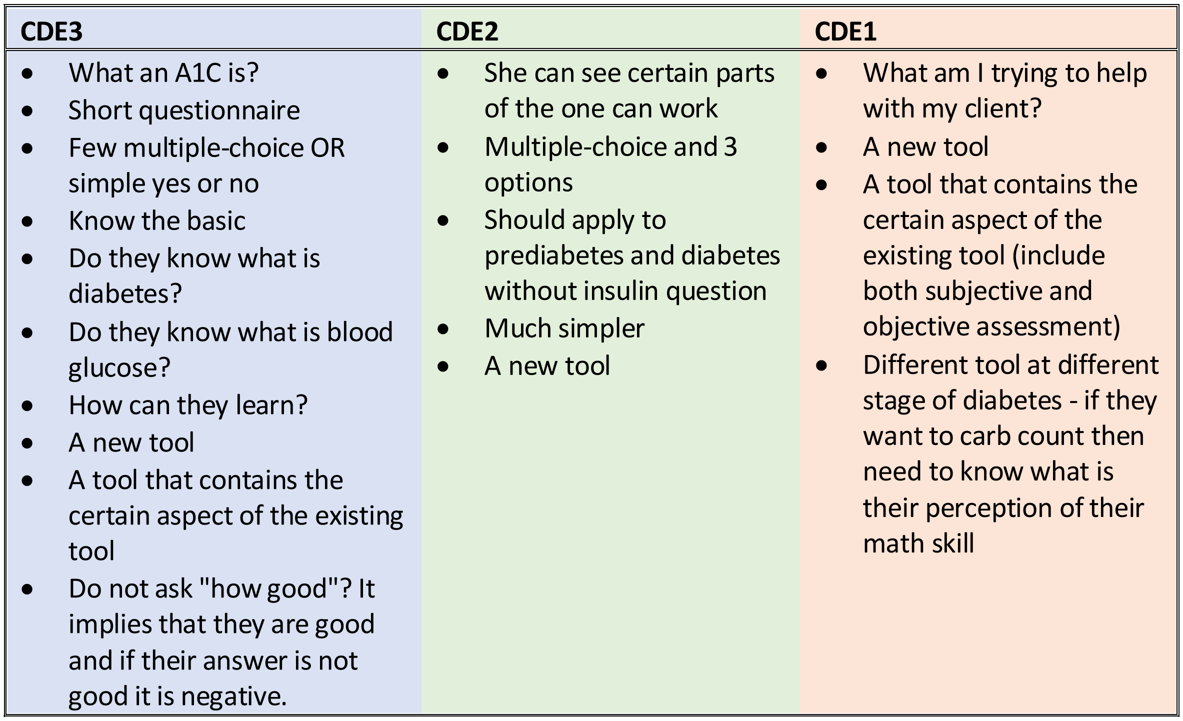
CDEs unanimously stated that none of the selected tools would be appropriate for use in their practice setting. One CDE mentioned that she could try to use the Diabetes Numeracy Test since it is short, but she is unsure if that would be valuable considering all the negative aspects of the tool. All CDEs suggested that a new tool should be developed (Table 5).

Summary of Responses on Characteristics of an Ideal Tool in the Practice.

One CDE suggested that a diabetes health literacy tool should include a short questionnaire with multiple-choice or simple yes or no answers. A second CDE suggested that having multiple choice questions with three options. All CDEs noted that they would like the new tool to include a particular aspect of the existing tools. All three CDEs explained that they preferred a tool that includes both subjective and objective assessment elements. Another suggestion was that the tool should take into consideration the different stages of clients' diabetes condition (Table 6).

Table 6

Characteristics of an Ideal Tool: Verbatim Responses of CDEs



CDE3	CDE2	CDE1
• What an A1C is? • Short questionnaire • Few multiple-choice OR simple yes or no • Know the basic • Do they know what is diabetes? • Do they know what is blood glucose? • How can they learn? • A new tool • A tool that contains the certain aspect of the existing tool • Do not ask "how good"? It implies that they are good and if their answer is not good it is negative.	• She can see certain parts of the one can work • Multiple-choice and 3 options • Should apply to prediabetes and diabetes without insulin question • Much simpler • A new tool	• What am I trying to help with my client? • A new tool • A tool that contains the certain aspect of the existing tool (include both subjective and objective assessment) • Different tool at different stage of diabetes - if they want to carb count then need to know what is their perception of their math skill

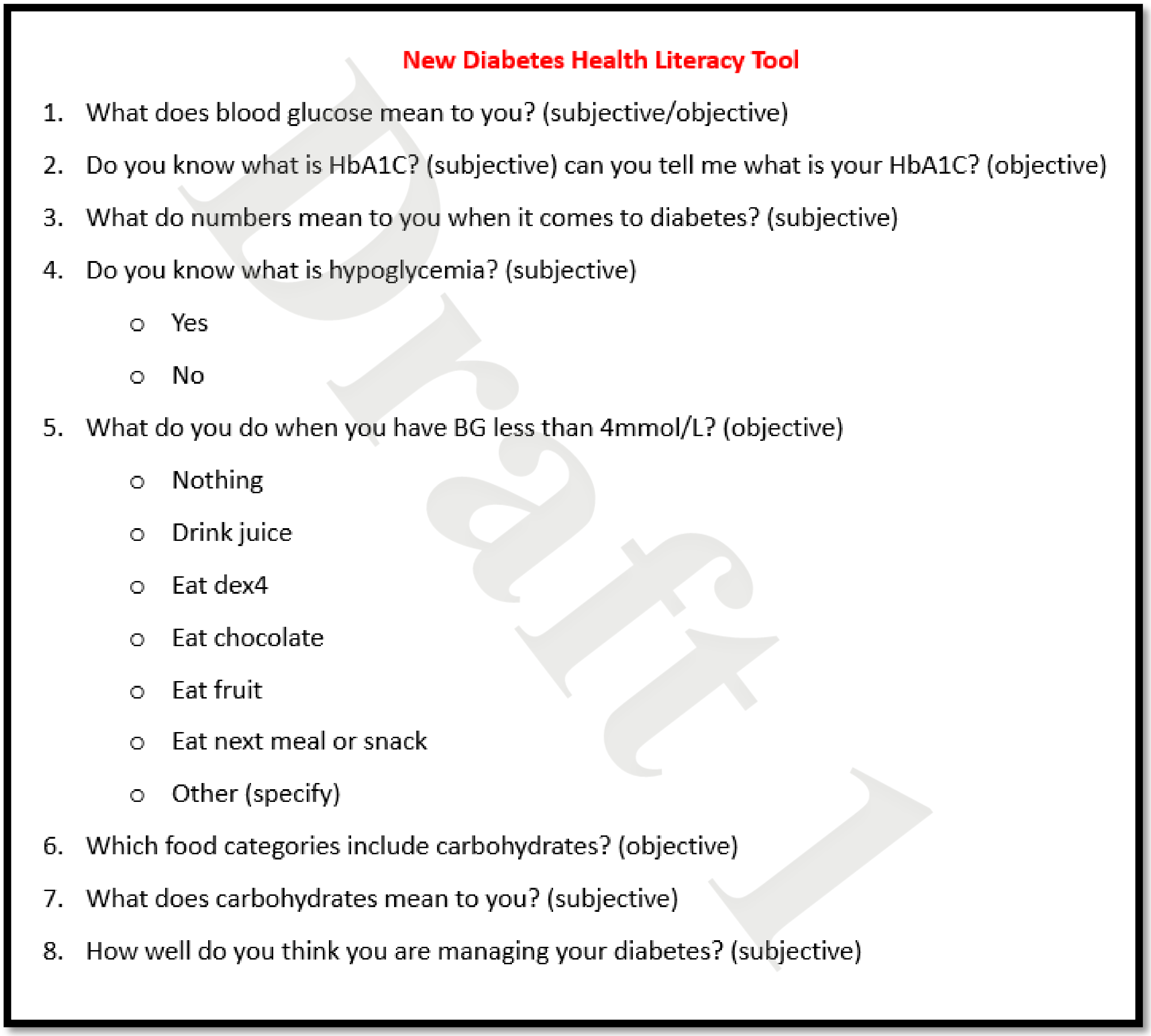
Phase Three

New Health Literacy Tool

Based on the comments received from CDEs in phase two, I created a draft of a new health literacy tool and shared it with educators via a live shared document enabling them to enter their comments and suggest revisions anonymously. Figures 4 to 7 illustrate the iterative process of achieving consensus on a health literacy tool that the diabetes educators used in practice as a part of this study. Figure 4 is the first draft.

Figure 4

Diabetes Health Literacy Tool Draft 1



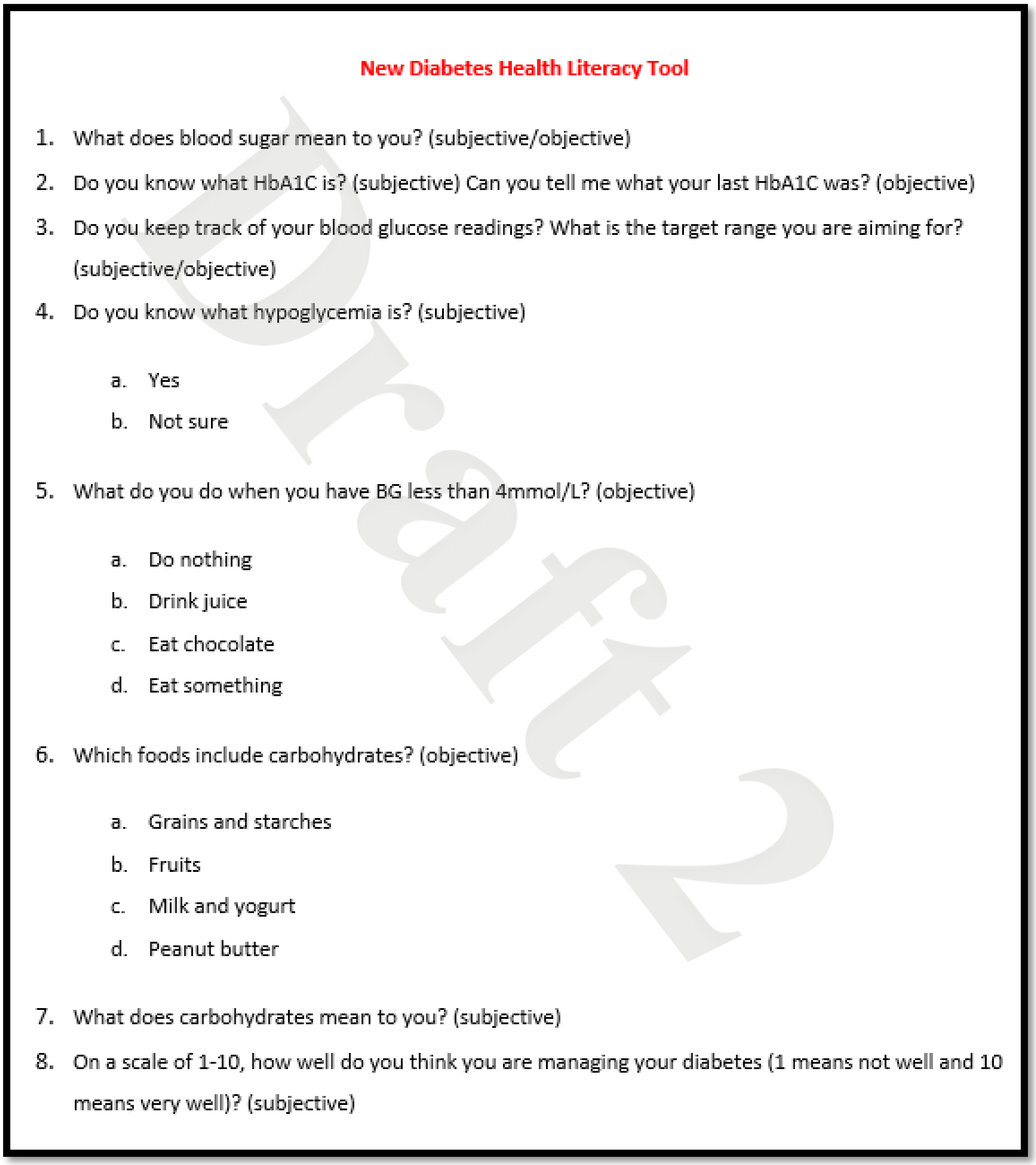
New Diabetes Health Literacy Tool

1. What does blood glucose mean to you? (subjective/objective)
2. Do you know what is HbA1C? (subjective) can you tell me what is your HbA1C? (objective)
3. What do numbers mean to you when it comes to diabetes? (subjective)
4. Do you know what is hypoglycemia? (subjective)
    - Yes
    - No
5. What do you do when you have BG less than 4mmol/L? (objective)
    - Nothing
    - Drink juice
    - Eat dex4
    - Eat chocolate
    - Eat fruit
    - Eat next meal or snack
    - Other (specify)
6. Which food categories include carbohydrates? (objective)
7. What does carbohydrates mean to you? (subjective)
8. How well do you think you are managing your diabetes? (subjective)

After receiving comments in the shared file, I entered all the comments and revised the tool, and I sent Figure 5 to the CDEs separately to see if they have further comments and considerations or if they would like to start using it. Then, I received multiple comments again from 2 CDEs.

Figure 5

Diabetes Health Literacy Tool Draft 2



New Diabetes Health Literacy Tool

1. What does blood sugar mean to you? (subjective/objective)
2. Do you know what HbA1C is? (subjective) Can you tell me what your last HbA1C was? (objective)
3. Do you keep track of your blood glucose readings? What is the target range you are aiming for? (subjective/objective)
4. Do you know what hypoglycemia is? (subjective)

    a. Yes
    b. Not sure

5. What do you do when you have BG less than 4mmol/L? (objective)

    a. Do nothing
    b. Drink juice
    c. Eat chocolate
    d. Eat something

6. Which foods include carbohydrates? (objective)

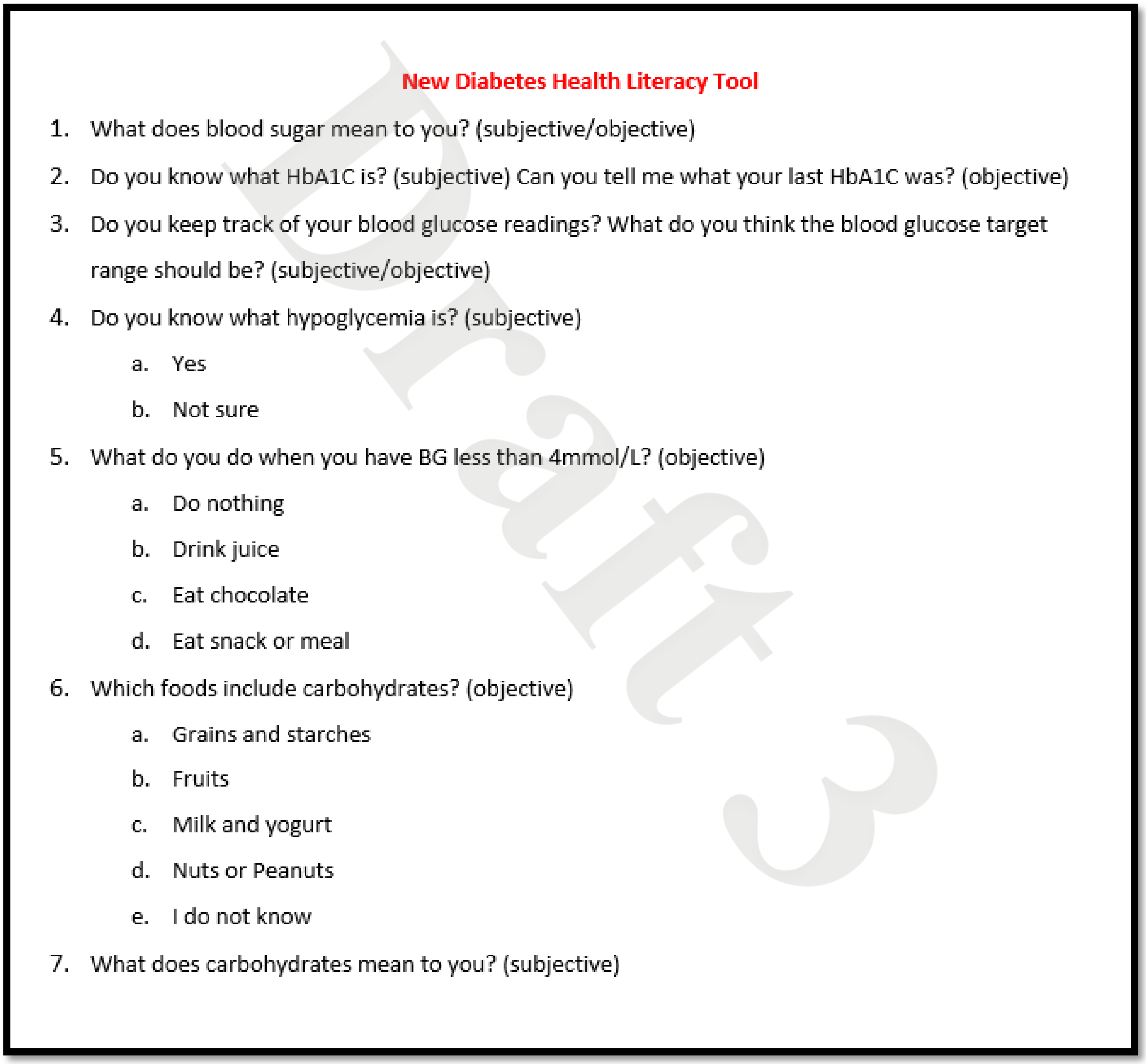
    a. Grains and starches
    b. Fruits
    c. Milk and yogurt
    d. Peanut butter

7. What does carbohydrates mean to you? (subjective)
8. On a scale of 1-10, how well do you think you are managing your diabetes (1 means not well and 10 means very well)? (subjective)

After receiving the comments, I entered the comments and revised the tool to ensure the changes requested by the CDEs were reflected in the new tool. Then, I sent Figure 6 to the CDEs separately to see if they have further comments and considerations or if they would like to start using it. Then, I received comments again from CDEs on draft three of the tool.

Figure 6

Diabetes Health Literacy Tool Draft 3



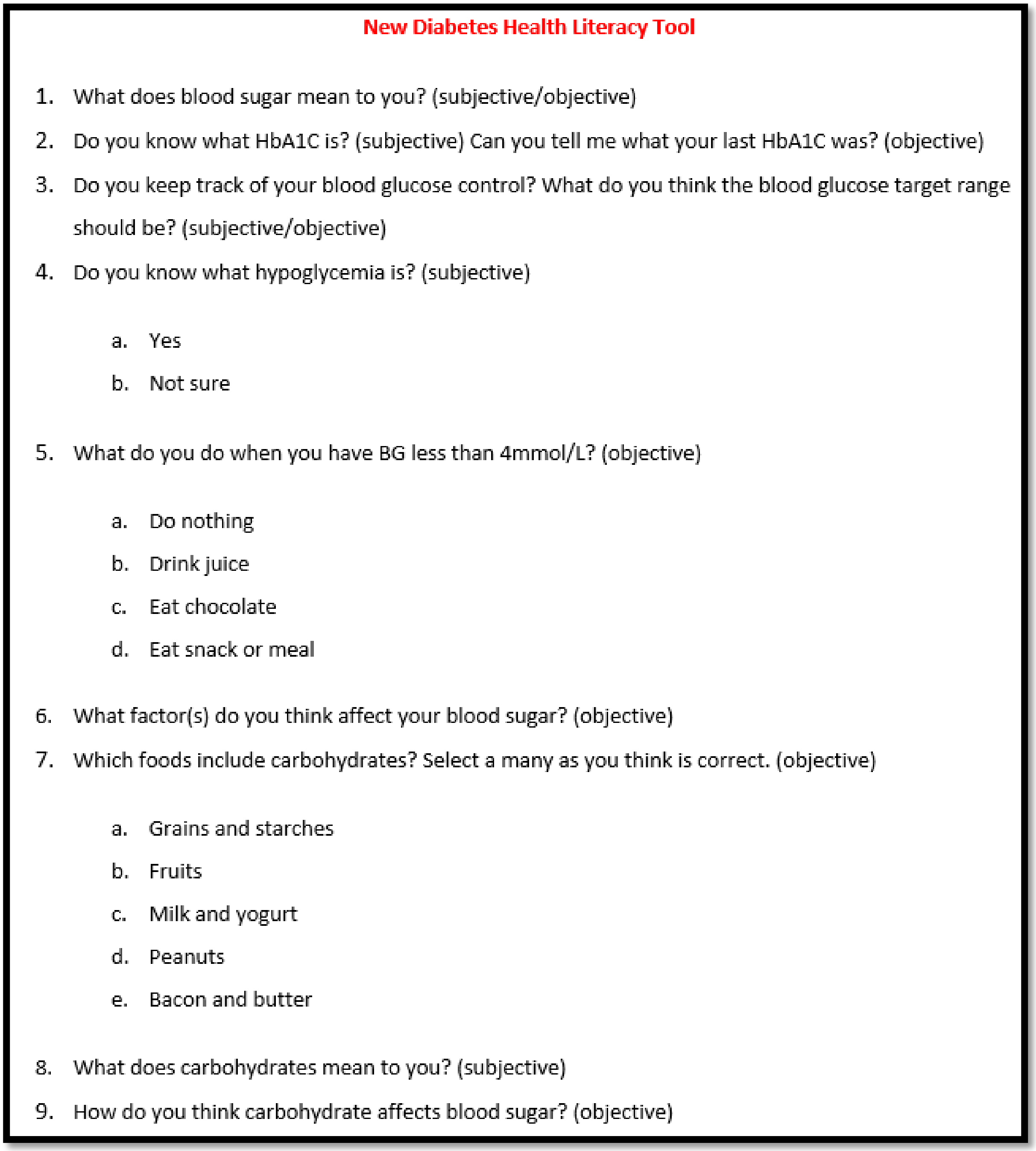
New Diabetes Health Literacy Tool

1. What does blood sugar mean to you? (subjective/objective)
2. Do you know what HbA1C is? (subjective) Can you tell me what your last HbA1C was? (objective)
3. Do you keep track of your blood glucose readings? What do you think the blood glucose target range should be? (subjective/objective)
4. Do you know what hypoglycemia is? (subjective)
    a. Yes
    b. Not sure
5. What do you do when you have BG less than 4mmol/L? (objective)
    a. Do nothing
    b. Drink juice
    c. Eat chocolate
    d. Eat snack or meal
6. Which foods include carbohydrates? (objective)
    a. Grains and starches
    b. Fruits
    c. Milk and yogurt
    d. Nuts or Peanuts
    e. I do not know
7. What does carbohydrates mean to you? (subjective)

The CDEs agreed that draft four (Figure 7) is the final version that they will use in the practice setting. They agreed to use the tool with their English-speaking clients on their initial phone visit.

Figure 7

Diabetes Health Literacy Tool Draft 4



New Diabetes Health Literacy Tool

1. What does blood sugar mean to you? (subjective/objective)
2. Do you know what HbA1C is? (subjective) Can you tell me what your last HbA1C was? (objective)
3. Do you keep track of your blood glucose control? What do you think the blood glucose target range should be? (subjective/objective)
4. Do you know what hypoglycemia is? (subjective)

    a. Yes
    b. Not sure

5. What do you do when you have BG less than 4mmol/L? (objective)

    a. Do nothing
    b. Drink juice
    c. Eat chocolate
    d. Eat snack or meal

6. What factor(s) do you think affect your blood sugar? (objective)
7. Which foods include carbohydrates? Select a many as you think is correct. (objective)

    a. Grains and starches
    b. Fruits
    c. Milk and yogurt
    d. Peanuts
    e. Bacon and butter

8. What does carbohydrates mean to you? (subjective)
9. How do you think carbohydrate affects blood sugar? (objective)

Phase Four

Survey Results

The final version of the new diabetes health literacy tool was disseminated to CDEs for use with their clients. The educators used the tool for five and a half weeks with a total of 20 clients. Then, I distributed a survey via email to them individually prior to the final focus group, and they completed the survey in a way that their responses were anonymous. The participants' ages ranged between 20-50 years old. Two of the participants were Registered Dietitians (RDs) and CDEs and one participant was a Registered Nurse (RN) and CDE.

When participants were asked about the usefulness of the new health literacy tool, two participants were neutral about it, and one participant found the tool to be helpful. All the CDEs mentioned that the new health literacy tool was helpful in assessing their clients' health literacy. When CDEs were asked how their clients felt about the tool, two of the CDEs responded as neutral, and one CDE mentioned that her clients found it helpful. Two of the CDEs found the subjective questions, indicated in the health literacy tool, to be helpful, and one CDE found the subjective questions being neutral. However, in response to the usefulness of the objective questions in the new health literacy tool, all CDEs responded positively (two found it helpful and one found it very helpful). Only one CDE found the length of the tool as being appropriate, and the other two CDEs found the tool to be too long (Appendix G).

Phase Five

Final Focus Group

The final focus group was conducted after the CDEs completed the survey. CDEs revealed that they used the new diabetes health literacy tool with a total of twenty clients. One CDE used the tool with ten clients, and the clients had type 1 diabetes, type 2 diabetes, and prediabetes (two were newly diagnosed with type 2 diabetes). One CDE used the tool with seven clients who had type 2 diabetes and prediabetes, and one CDE used the tool with two clients with type 2 diabetes. The CDE who used the tool with only two clients mentioned that due to pandemic-related issues, she was off for a week during that period, and also, most of her days she had follow-up visits with her clients as well as she had multiple new clients, not attending the phone visits (Table 7). With permission from CDEs, I recorded the focus group, and transcribed the information after, in addition to taking notes during the focus group.

What Worked Well?

One CDE declared that the new health literacy tool started a good discussion and allowed exploration of other areas that were not food or medication-related during the virtual visits. She found it helpful to understand clients' existing level of diabetes knowledge during her phone visit with clients noting that the objective component of the assessment tool worked well. Two CDEs agreed that the assessment tool worked well even when the clients were new to them but not to the diabetes program. They further explained that they expected clients already in the program at CDEPO to have specific knowledge of diabetes health literacy. However, the use of the tool revealed otherwise, suggesting that a health literacy tool helps detect deficiencies in knowledge.

What Did Not Work Well?

One CDE noted that the subjective questions were vague, and all the CDEs agreed that the first question was vague and therefore challenging for clients to answer. Additionally, two of the CDEs found the long, and they further explained that their clients wanted to know the answers to all the questions, which was time-consuming. One educator said that she was unsure if the tool would work well for clients with prediabetes.

How Many Questions Would be appropriate?

All CDEs agreed that the objective questions would be more appropriate, two CDEs voted in favour of removing the subjective questions, whereas the third CDE offered that she would consider keeping one subjective question but not more than that. One CDE mentioned that there should be an option of "I do not know" in the multiple-choice answers so the clients can choose this option if they do not know the answer or are hesitant to share their response.

When would be appropriate to use the tool?

The answers to this question were mixed, but the discussion and collaborative thinking were valuable. One educator mentioned that she would prefer to use the health literacy tool during the first with clients, including the newly diagnosed, before providing diabetes education. She shared that one of her clients knew a lot about diabetes, but she would not have known this if she had not asked the questions in the assessment tool. Another educator suggested that the assessment may be suitable for clients familiar with the program or used after new clients have had a few visits with their CDE. Yet another educator expressed that it would be appropriate to ask a client during their first visit how much diabetes knowledge the client has received. One of the three educators offered that the time frame during which clients previously received diabetes education and how much they received should be considered.

All the educators agreed that the new health literacy tool should shortened using mostly objective questions. Additionally, a different version of the tool should be developed for individuals with prediabetes, existing clients, and new clients on whether or not they are on insulin. I suggested that if the educators would prefer a tool with two or three questions followed by a more extended version depending on the educators' need assessment, such as Patient Health Questionnaire (PHQ-2 & PHQ-9). The educators agreed that this could work.

Table 7

Final Focus Group

	CDE 1	**CDE 2**	**CDE 3**
Background	-Used with 10 clients with Type 1, 2 and prediabetes, 7 were diabetes (2 newly diagnosed type 2). -Their knowledge were wide ranging, some had more time and received education but I even used it clients with Type 1 and prediabetes.	-Used it with 7 clients, diabetes and prediabetes	-Used it with 2 clients, both had type 2 diabetes
What worked well?	-Objective part: do you know that…. -The questions started a good discussion and allowed exploration other areas that were not food or medication related.	-It gave me an understanding of what the client's current understanding of diabetes is. -I liked the multiple-choice answers. -It worked well for my clients that were new to me but seen by another educator before because I would have assumed they knew the information but found out they did not.	-Agree with CDE 2 because with existing clients I would have assumed that the clients already have specific knowledge because the education was already provided but I found it they do not.
What did NOT work well?	-The subjective part is very vague -They cannot answer “What Blood Sugar is?” -Last question has to be rearranged because they would know the answer before the last one.	-It was a bit long. -Clients wanted to know the answers to all the questions. -The question “What does blood sugar mean” was vague. -I do not know if it works well for prediabetes.	-Too long -Clients wanted to know the answers to all the questions so that took away from the appointment. -The first question was very vague.
How Many questions would be appropriate?	-Solely objective questions	-I do not mind to have one subjective one in addition to objective ones.	-Only objective would be enough. If more objective, there should be an "I do not know the answer" so they would not have to select from the options

When would be appropriate to use the tool?	-Newly diagnosed. -One client learned a lot before attending the session. -I would like to do it at the beginning before providing education. -The best way is how much diabetes knowledge you have.	-It could be good for existing clients or after a few visits for new clients. -Should not be used for a person who did not receive any education before. At the beginning of the education session and then repeat it. -I'd rather to not ask it at the first visit for new clients.	-It depends on when they received the education. -Should we add a time frame on when?
Should we ask: Have you received any education before?	-Asking: How much knowledge of diabetes you have? Instead	-Yes	-Perhaps, depending on when she received the diabetes education?
Should we ask: How much knowledge of diabetes you have?	-I like that better		-Perhaps saying "how much diabetes education you received and when?"
How and when you want to ask the tool? To reduce the client's need to get the answer	-The first few visits or doing pre-post	-I would like to ask it at the follow-up appointment for new clients	-It depends
Should there be pre-post education?	-Yes, it would be good to have a pre-post education	-Not really	
Should there be any tool?	-Needs to be tailored depending on type of diabetes	-Any tool is better than no tool. -Tailoring and reducing the questions to 3-4 questions.	-Having different types of tool for different clients (existing, prediabetes, new, diabetes, on insulin) -Tailoring it would be good and also making it short
Short one for the first visit like PHQ1 and another one for follow-up visits	-That can work	-That can work	-It could be a good idea -If short can be used for the first visit because there are other priorities

Independent Evaluation of the Assessment Tool

To ensure the new diabetes health literacy tool is valid and applicable in the practice setting, another CDE expert at CDEPO agreed to evaluate the tool independently. She found the new diabetes health literacy tool valuable and suitable for clients in the clinical practice setting. She stated that the assessment tool is an appropriate length and easy to administer, and the simplicity of the design lends itself well to collaborating with translators. The added dimension of combining both straightforward objective questions with short, open-ended subjective questions can yield a great deal of insight into clients' perspectives, understanding, as well as lived experiences. She suggested that there might need to be modifications made to this tool or variations that ask different questions for other aspects of diabetes care, like for those living with Type 1 Diabetes or Prediabetes. However, this tool will be appropriate for the majority of CDEPO clients. She added that it is immensely challenging to assess clients' health literacy consistently, not only clients' prior knowledge of diabetes care but also if they understand important terminologies.

“As CDEs, we often utilize these terminologies, sometimes better described as medical jargon, in a casual way. If we are not able to accurately assess the health literacy of the client, we could be speaking in a way that would not only be unhelpful for the person but also could make them feel overwhelmed and isolated, unable to fully comprehend our plan for their plan of care but often finding the need to quietly acquiesce anyway. Not understanding their plan or what we are teaching them can leave a client feeling powerless and potentially even less in control of this challenging chronic, progressive disease” (Independent CDE).

Conclusion

In this chapter, I presented the findings of my research study. I discussed the five phases of the study, and in each phase, I explained in detail the findings as I received them. I discussed the two focus groups (initial and final focus groups) that I conducted to better understand the perspectives of the CDEs and allowed for the co-construction of knowledge among the CDE participants and the researcher. Additionally, I provided detailed information along with tables and figures that summarized the findings and sought to validate this study's final version of diabetes health literacy tool.

Chapter 6: Summary, Discussion and Conclusion

Initially, the focus of this study was to assess existing diabetes health literacy tools and explore if they would be applicable to use in the practice setting. Given that none of the existing tools were acceptable, a new tool was created and assessed for use in a clinical setting with clients diagnosed with diabetes. The study participants were Certified Diabetes Educators (CDEs), who were health care providers (HCPs) “committed to excellence in diabetes education” (The Canadian Diabetes Educator Certification Board, 2023). The CDEs were selected from an Ottawa based community diabetes program named Community Diabetes Education Program of Ottawa (CDEPO).

Why Virtual Visits?

In phase one of the study, I located six diabetes health literacy tools in the literature. After further reviewing these six tools, I concluded that their use in practice has limitations. Phone visits are the primary and first mode of communication with clients at many diabetes education programs, specifically in CDEPO. As highlighted by Topol (2020), the phone is the most accessible method of connection with clients, since not everyone has access to or the ability to use video technology. Prior to the COVID-19 pandemic, CDEs occasionally communicated via phone with their clients. However, since the pandemic, diabetes education in Ottawa has switched exclusively to phone visits, and this transformation is not changing anytime soon. It is expected that virtual visits will continue to be used throughout healthcare settings in the post COVID-19 era (Topol, 2020).

Understanding the Needs of Clients with Diabetes

In this research study, knowledge about the efficacy of several health literacy tools was co-constructed between the researcher and a small team of Healthcare Providers (HCPs) who worked with their clients. As a CDE working with many clients who have diabetes, I realized the importance of understanding clients' educational needs, which are not always obvious. There is a need to improve HCPs' knowledge of clients' needs because that is the first step in developing a rapport with clients and supporting them in ways that are beneficial to them. To improve any chronic condition, it is important to first understand the person who is living with the chronic condition. Providing client-centered care requires a deep appreciation for and consideration of the whole person and their needs (Nelligan et al., 2022). Individuals will be better prepared to manage their chronic condition once such a need assessment is completed, and suitable education is provided.

Use of the Quality Improvement Approach

I used a quality improvement (QI) research design because its ontological underpinnings are processed-based, leading to continuous improvement, context-driven, and practical, which is necessary for clinical settings (Eby, 2019). The Continuous Quality Improvement (CQI) process is intended to present “frequent, small reviews and changes” that present opportunities for improvement in practice settings with clients and patients. CQI includes various QI methods such as plan-do-study-act (PDSA), Baldrige, Lean, and Six Sigma. “In healthcare, in particular, CQI adopts and operates the Institute for Healthcare Improvement Model for Improvement” (Eby, 2019, p. 9). While CQI is popular in healthcare, it has also found traction in higher education, often under the name of Quality Assurance (QA).

Working with the CDEs

After reviewing multiple diabetes health literacy tools, I selected three of the existing diabetes health literacy tools for CDEs to assess the appropriateness of the tools in the practice setting (explained in detail in Chapter 5). These tools were: Diabetes Knowledge Test, Diabetes

Numeracy Test 5, and Health Literacy Scale-Subjective Numeracy Scale. The reason I selected these tools was that the tools were the shortest, most appropriate tools to be used over the virtual visit, and included essential aspects of diabetes management, such as assessing clients' understanding of hypoglycemia which is low blood glucose that can be fatal.

I shared the aforementioned tools with the CDEs via separate emails along with a series of three open-ended questions to provoke the educators’ thoughts prior to meeting virtually for the initial focus group. Based on the responses received from CDEs (CDE 1, CDE 2, CDE 3), I identified the common themes. CDE 1 provided an in-depth assessment of the questions within the tools, while CDE 2 and CDE 3 provided their general views. Based on the email responses, CDE 1 and CDE 2 both mentioned that they would be open to using the Diabetes Numeracy Test in the practice setting with their clients. However, CDE 3 did not find any of the existing tools to be appropriate for usage in the practice setting.

After I received the email responses, I met with the CDEs during the initial focus group that was held over a video visit (via Zoom Pro) in order to have a further enriched group discussion. CDE 1 expressed mixed feelings about the tools, even though previously, in the email response, she found that Diabetes Numeracy Test 5 would be a tool she could use in practice. However, during the focus group, she voiced that despite the shortness of the tool, it is actually challenging to implement in practice. Additionally, CDE 1 and CDE 2 found some of the questions in Diabetes Numeracy Test 5 so complex that clients need to have a calculator or math degree, which was humorous from their view. While CDE 1 was open to entertaining the use of the Health Literacy Scale-Subjective Numeracy Scale (HLS-SNS) tool, CDE 3 was very clear on her opinion regarding the HLS-SNS tool as she said without delay that "I hate it". The final recommendation of the CDEs was that the existing tools are inappropriate for use in their practice setting because they are too complex, too long, and confusing to be used over the phone. The discussion in the initial focus group was meaningful because although CDE 1, CDE 2, and CDE 3 gave their individual feedback in the email responses, they could reach a consensus during the focus group.

Co-constructing a Tool for the Practice Setting

I asked the CDEs, to provide their comments about the type of tool they prefer. The consensus was that a diabetes health literacy tool should include objective and subjective questions and should be short with multiple-choice answers or simple yes or no answers. CDEs agreed that the tool should apply to clients with prediabetes and diabetes. CDE 3 believed that it is essential for a client to understand "what an A1C is?". CDE 3 strongly believed that the new tool must be short and straightforward, and CDE 2 agreed with her.

Developing a New Health Literacy Tool

Based on the comments received from CDEs, I drafted a new health literacy tool that captured all the ideas that the CDEs suggested. Then, I asked these educators to provide their comments on the draft version of the new diabetes health literacy tool. I shared the new tool in a “live shared document” that the CDEs had access to so they could enter their revisions directly into the text and provide their comments and other views. To respect the anonymity, they did not include their names when they provided comments. They were able to provide their own comments and respond to each other’s comments. Then, I emailed them, individually, a revised version, and they provided me with additional comments on the penultimate draft. I expected that version two would be the final version since they agreed on that when they were all using the shared document; however, they had more comments to provide via email on that draft. Surprisingly, some of their comments contradicted each other such as the number of options on the multiple-choice answers and the wording of specific questions or answers. Interestingly, every educator had a unique view of diabetes education and health literacy. After more revisions, as mentioned in more detail in Chapter 5, the CDEs agreed to use this version of the diabetes health literacy tool (draft four which is noted in Figure 4 in Chapter 4) with their English-speaking clients during their first phone visit with each individual. As previously explained, the phone visit was selected because of its accessibility and common usage in diabetes management.

Survey Results and Focus Group after Using the Tool in Practice

After the educators used the new diabetes health literacy tool for over five weeks, I sent an anonymous survey via email to them individually prior to focus group two so they could share their initial thoughts anonymously. As mentioned earlier, two CDEs were Registered Dietitians (RDs), and one was a Registered Nurse (RN). It is important to note that initially, the CDEs were selected based on convenient sampling and all were all RDs. However, due to one RD's last-minute availability change, a Registered Nurse was selected instead.

Using the New Tool in Practice

CDEs used the tool with a total of 20 clients who had type 1 diabetes, type 2 diabetes, and prediabetes. Even though the purpose of the study was to use the tool for clients with type 2 diabetes, the CDEs also used the tool with clients with type 1 diabetes and prediabetes, which led to an unexpected outcome that the tool can be helpful in use for clients with type 1 and type 2 diabetes and prediabetes.

CDEs' responses were positive regarding the usefulness of the new health literacy tool. One CDE mentioned that she found the tool useful because it created starting point to have a discussion with the client regarding other areas that were not food or medication-related, which are usually the main topic of conversation at the individual visits. She found it helpful to understand clients' existing level of diabetes knowledge and learn what information the client received prior to attending the phone visit with her.

All CDEs' were positive regarding the usefulness of the new health literacy tool. One CDE mentioned that they found the tool helpful because it created starting point to have a discussion with the client regarding other areas that were not food or medication-related, which are usually the main topic of conversation at the individual visits. They found it helpful to understand the client's current level of diabetes knowledge and learn what information the client received before attending the phone visit during the study.

Two CDEs in this study shared that the tool worked for returning clients familiar with the program. These participants explained that because clients already had a visit with a different educator, they would have assumed they had already received an appropriate education, but this is not always the case. CDEs said that the tool helped them identify gaps in client's knowledge. In addition, participants shared that asking the health literacy questions when clients were entirely new to the program led to a more extended visit because these clients wanted to know the answer to the questions that CDEs during that visit.

When CDEs were asked how their clients felt about the tool, one CDE found that the objective questions of the tool worked well because the clients were motivated to learn about the answers. However, two CDEs found that clients became too focused on wanting to know the answers to the questions on the spot, which was challenging.

Two of the CDEs found the subjective questions of the health literacy tool helpful, and one CDE rated the subjective questions as acceptable. Furthermore, all the CDEs found the objective questions of the health literacy tool to be useful or especially useful. When the CDEs were asked to elaborate they responded that the subjective questions were vague therefore it was difficult for them to understand clients' diabetes health literacy based on their answers to those questions. The CDEs found the objective questions were more appropriate than the subjective questions reducing the chance of error in clients' understanding of the question.

The CDE who was also an RN, found the tool extremely useful with all her clients stated that she would prefer to use the tool at the first visit with each client. However, the other two CDEs who were RDs, preferred to have the choice of using the tool during the first visit or subsequent visits because they found that the questions take away time from making a connection with the client and getting to know their immediate needs.

CDEs Consensus and Conclusions

In the final focus group, all educators agreed that a shorter version of the new diabetes health literacy tool would be more practical and could be accomplished using mainly objective questions thereby limiting the number of subjective questions. Additionally, educators suggested different versions of the tool for individuals with different conditions: prediabetes, existing clients, and new clients on whether or not they are on insulin. The most important conclusion in this study is having a diabetes health literacy tool will help CDEs during virtual visits with clients. However, further modifications need to be made to the version of the tool co-created during this study. This is a positive outcome, especially given the challenges with the notion of change in the healthcare setting (Safi et al., 2018). The CDEs agreed that using diabetes health literacy tool would be a change that they would like to adopt in their practice during virtual visits with clients. Accepting change can be demanding and strenuous as it requires modification to the existing habits; however, when the employees partake in the model of change, it is easier to accept the need for change (Al-Abri, 2007). Therefore, CDEs' input in the adjustment needs that are yet to be made to the new tool will not only improve the tool but will help CDEs adapt it to their practice setting.

CDEs' and Researcher's Recommendations

Most of the CDEs found the tool too long and recommend a shorter version. CDEs overall preferred the multiple-choice format of the answers. The following are recommendations based upon this study's findings.

- Include fewer questions in the diabetes health literacy tool.
- Continue to have multiple-choice questions the option of selecting "I do not know".
- Only keep the objective questions, and if necessary, only keep one subjective question.
- Develop one tool for clients with prediabetes and type 2 diabetes who are not on insulin.
- Develop a different tool for clients with type 2 diabetes on insulin and type 1 diabetes.
- The tool should be used during CDEs' first visit with existing clients who are new to that specific educator but not new to the program.
- If the client is new, the educator can decide to use the tool on the first or second visit.
- It would be beneficial to ask, "have you previously received any diabetes education (if yes, when and where).

Limitations of the Study

I conducted this study in one diabetes community program: the Community Diabetes Education Program in Ottawa (CDEPO), the largest and most diverse program in Ottawa. However, the sample size was smaller than anticipated due to unexpected changes in the staffing;

therefore, only three CDEs could participate in the study to avoid disruption in the regular activity of the program.

Next Steps in Quality Improvement of the New Tool

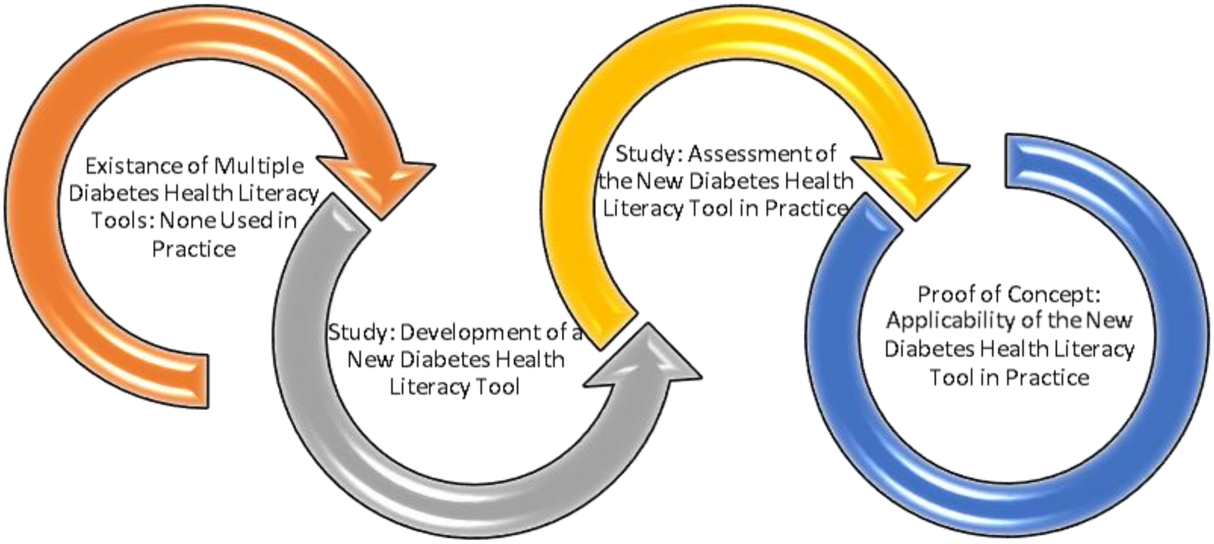
The changes requested by the CDEs can be applied to the new health literacy tool developed during this study, and the revised tool can be retested in CDEPO again for further assessment and implementation in clinical practice. Due to a limitation of the study, as discussed earlier in this chapter, it would be beneficial to repeat the study including more CDEs, both RNs and RDs. The tool needs further improvements and use by more CDEs. Additionally, further investigations can assess the benefits of having both a shorter and a longer version of the diabetes health literacy tool so that the educators can start with the shorter version, and if needed, use the longer version to understand clients' health literacy better. This is the continuous nature of Quality Improvement. The study can also be repeated in other diabetes clinics in Ottawa and province of Ontario.

Health Literacy Tool and Proof of Concept

Pratt (2022) affirmed that the goal of a Proof of Concept is to assess if a concept or idea is feasible and practical. In this study, the participants agreed that with further modifications, the tool will be beneficial for use in a practice setting (Figure 8).

Figure 8

Proof of Concept: Diabetes Health Literacy Tool



Conclusion

Diabetes is a chronic condition that leads to an increase in blood glucose and requires understanding and self-management of multiple factors, such as eating habits, physical activity, medications, stress, or illness (Meng et al., 2016; Sherifali et al., 2018). Therefore, clients need sufficient knowledge and education on self-management, which requires guidance from healthcare providers such as Certified Diabetes Educators (CDEs) (Meng et al., 2016).

The final recommendation of CDEs, at the end of this research study, after the diabetes health literacy tool was used by CDEs for approximately five and a half weeks, was that the tool useful but requires further modification in order to ensure it would be more appropriate for use in the practice setting. The fact that the CDEs were open to adopting the diabetes health literacy tool in their practice was inspiring, as change is challenging within the healthcare setting. For the purpose of this study, the tool was not modified further because of the limitations discussed in Chapters 4 and 6. However, a shorter diabetes health literacy tool with only the objective diabetes knowledge assessment (not the subjective assessment) was the important criterion that was mentioned by the CDEs that they would like to see in the new version of the tool. Based on the latest recommendations made by the CDEs, further improvements can be made to the diabetes health literacy tool, and once the tool is approved at the program level, it can be used in a practice setting to help the CDEs at CDEPO.

In order to ensure other programs in Canada are aware of the development of this new diabetes health literacy tool, the results of this study will be submitted to Diabetes Canada Conference in the fall of 2023. Additionally, in order to also disseminate the results internationally, the results will be submitted to the American Diabetes Association (ADA) and/or Association of Diabetes Care & Education Specialists (ADCES), which are recognized associations for diabetes management.

Additionally, the health literacy tool can also be assessed in other diabetes programs in other cities in Canada to evaluate its usefulness. While this tool is currently specific to diabetes health literacy, multiple chronic health conditions, such as hypertension and heart failure, could use a modified version of the tool to help healthcare providers provide tailored education to help clients manage their conditions. However, further research is required to assess the feasibility of using health literacy tools in chronic disease management. Additionally, I am hoping the tool can be also assessed and disseminated in other countries as the goal of my study aligns with goal three of United Nations Sustainable Development Goals (SDG), “Ensure healthy lives and promote well-being for all ages” (United Nations, 2023). More specifically, SDG Indicator 3.4.1 refers to reducing premature mortality from non-communicable diseases including diabetes by one-third on a global basis.

The Future of Telemedicine

During the COVID-19 pandemic, diabetes education visits changed exclusively to virtual visits on the advice of public health agencies (Centres for Disease Control and Prevention, 2020; Diabetes Canada, 2020). Telemedicine gained popularity during the COVID-19 pandemic and most telemedicine users in Canada would like the virtual visit to continue in the future. A 2021 survey conducted in Canada by Capterra found that 84% of telemedicine users during the COVID-19 pandemic said that they would continue to use telemedicine in the post COVID-19 era. Forty one percent of respondents said that they prefer telemedicine because they did not think their medical issues required in-person assessment. Other participants noted that virtual appointments were available sooner and reduce the risk of contagion in the doctor's office (Anaya, 2021). Only 14% of the telemedicine users used video visits, while 76% of telemedicine users surveyed used phone visits.

Over the past several years, there have been multiple pandemics (i.e., H1N1, Ebola, SARS-CoV, MERS-CoV, and COVID-19) and future pandemics are highly likely. Telemedicine is a flexible option for providing high-quality healthcare while maintaining safety in the practice setting (Kichloo et al., 2020; Topol, 2020). Despite technological advances, the telephone currently provides a more generally accessible medium for virtual assessment, education, and care of diabetes patients.

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Appendix A

Certification of Ethical Approval

Athabasca University
RESEARCH CENTRE

CERTIFICATION OF ETHICAL APPROVAL

The Athabasca University Research Ethics Board (REB) has reviewed and approved the research project noted below. The REB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2) and Athabasca University Policy and Procedures.

Ethics File No.: **24888**

Principal Investigator:
Ms. Nazli Parast, Doctoral Student
Faculty of Humanities & Social Sciences\Doctor of Education (EdD) in Distance Education

Supervisor/Project Team:
Dr. Pamela Walsh (Supervisor)

Project Title:
Development of a Health Literacy Tool to Support Certified Diabetes Educators during Virtual Visits With Clients

Effective Date: August 30, 2022 **Expiry Date**: August 29, 2023

Restrictions:

Any modification/amendment to the approved research must be submitted to the AUREB for approval prior to proceeding.

Any adverse event or incidental findings must be reported to the AUREB as soon as possible, for review.

Ethical approval is valid *for a period of one year*. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

An Ethics Final Report must be submitted when the research is complete *(i.e. all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: **Date: August 30, 2022**

Tobias Wiggins, Chair
Faculty of Humanities & Social Sciences, Departmental Ethics Review Committee

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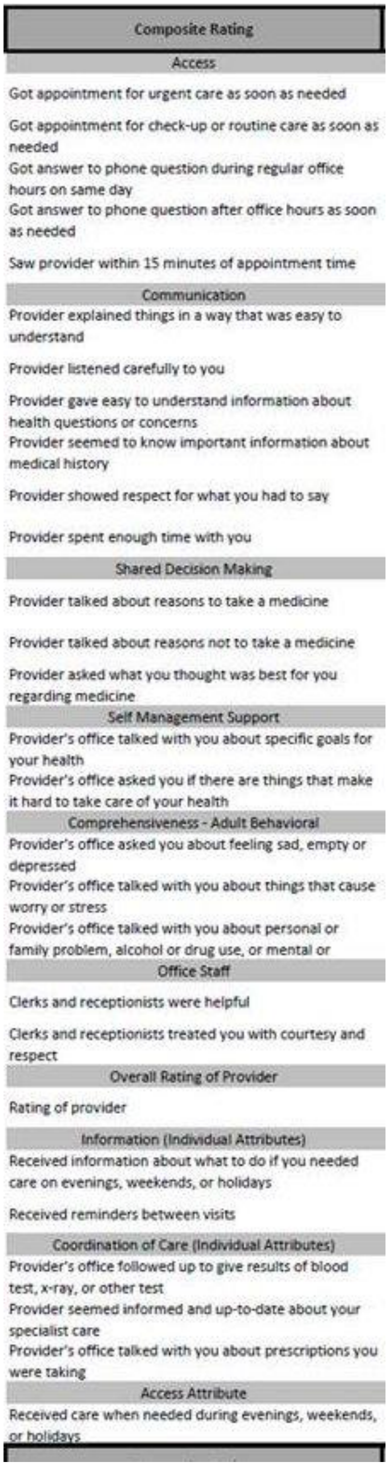
Athabasca University Research Ethics Board
University Research Services Office
1 University Drive, Athabasca AB Canada T9S 3A3
E-mail rebsec@athabascau.ca
Telephone: 780.213.2033

Appendix B

Health Literacy Tools

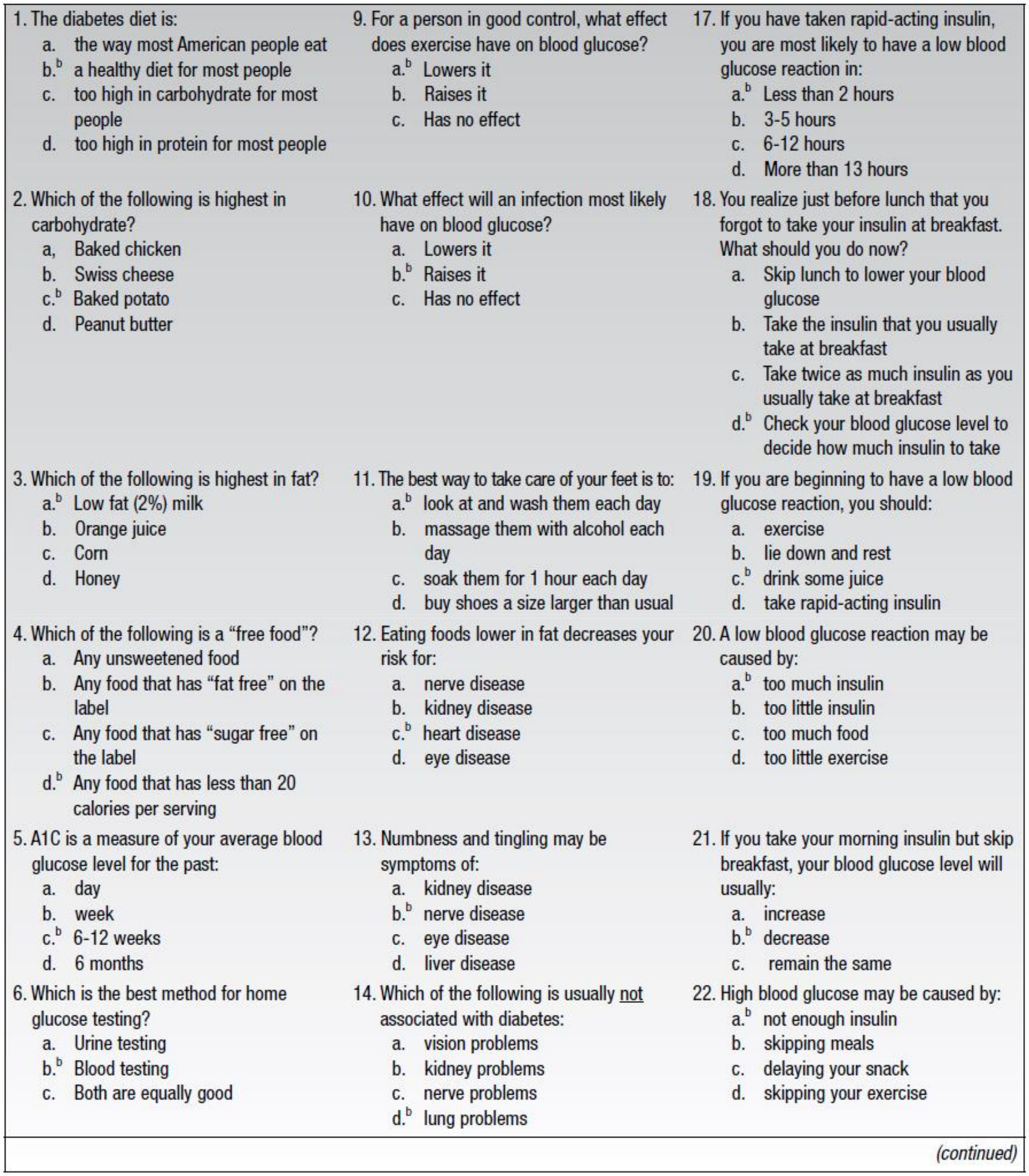
Consumer Assessment of Healthcare Providers and Systems (CAHPS)



Composite Rating
Access
Got appointment for urgent care as soon as needed
Got appointment for check-up or routine care as soon as needed
Got answer to phone question during regular office hours on same day
Got answer to phone question after office hours as soon as needed
Saw provider within 15 minutes of appointment time
Communication
Provider explained things in a way that was easy to understand
Provider listened carefully to you
Provider gave easy to understand information about health questions or concerns
Provider seemed to know important information about medical history
Provider showed respect for what you had to say
Provider spent enough time with you
Shared Decision Making
Provider talked about reasons to take a medicine
Provider talked about reasons not to take a medicine
Provider asked what you thought was best for you regarding medicine
Self Management Support
Provider's office talked with you about specific goals for your health
Provider's office asked you if there are things that make it hard to take care of your health
Comprehensiveness - Adult Behavioral
Provider's office asked you about feeling sad, empty or depressed
Provider's office talked with you about things that cause worry or stress
Provider's office talked with you about personal or family problem, alcohol or drug use, or mental or
Office Staff
Clerks and receptionists were helpful
Clerks and receptionists treated you with courtesy and respect
Overall Rating of Provider
Rating of provider
Information (Individual Attributes)
Received information about what to do if you needed care on evenings, weekends, or holidays
Received reminders between visits
Coordination of Care (Individual Attributes)
Provider's office followed up to give results of blood test, x-ray, or other test
Provider seemed informed and up-to-date about your specialist care
Provider's office talked with you about prescriptions you were taking
Access Attribute
Received care when needed during evenings, weekends, or holidays

(Weidmer et al., 2012)

Diabetes Knowledge Test



1. The diabetes diet is:
   - a. the way most American people eat
   - b.[b] a healthy diet for most people
   - c. too high in carbohydrate for most people
   - d. too high in protein for most people

2. Which of the following is highest in carbohydrate?
   - a, Baked chicken
   - b. Swiss cheese
   - c.[b] Baked potato
   - d. Peanut butter

3. Which of the following is highest in fat?
   - a.[b] Low fat (2%) milk
   - b. Orange juice
   - c. Corn
   - d. Honey

4. Which of the following is a “free food”?
   - a. Any unsweetened food
   - b. Any food that has “fat free” on the label
   - c. Any food that has “sugar free” on the label
   - d.[b] Any food that has less than 20 calories per serving

5. A1C is a measure of your average blood glucose level for the past:
   - a. day
   - b. week
   - c.[b] 6-12 weeks
   - d. 6 months

6. Which is the best method for home glucose testing?
   - a. Urine testing
   - b.[b] Blood testing
   - c. Both are equally good

9. For a person in good control, what effect does exercise have on blood glucose?
   - a.[b] Lowers it
   - b. Raises it
   - c. Has no effect

10. What effect will an infection most likely have on blood glucose?
    - a. Lowers it
    - b.[b] Raises it
    - c. Has no effect

11. The best way to take care of your feet is to:
    - a.[b] look at and wash them each day
    - b. massage them with alcohol each day
    - c. soak them for 1 hour each day
    - d. buy shoes a size larger than usual

12. Eating foods lower in fat decreases your risk for:
    - a. nerve disease
    - b. kidney disease
    - c.[b] heart disease
    - d. eye disease

13. Numbness and tingling may be symptoms of:
    - a. kidney disease
    - b.[b] nerve disease
    - c. eye disease
    - d. liver disease

14. Which of the following is usually not associated with diabetes:
    - a. vision problems
    - b. kidney problems
    - c. nerve problems
    - d.[b] lung problems

17. If you have taken rapid-acting insulin, you are most likely to have a low blood glucose reaction in:
    - a.[b] Less than 2 hours
    - b. 3-5 hours
    - c. 6-12 hours
    - d. More than 13 hours

18. You realize just before lunch that you forgot to take your insulin at breakfast. What should you do now?
    - a. Skip lunch to lower your blood glucose
    - b. Take the insulin that you usually take at breakfast
    - c. Take twice as much insulin as you usually take at breakfast
    - d.[b] Check your blood glucose level to decide how much insulin to take

19. If you are beginning to have a low blood glucose reaction, you should:
    - a. exercise
    - b. lie down and rest
    - c.[b] drink some juice
    - d. take rapid-acting insulin

20. A low blood glucose reaction may be caused by:
    - a.[b] too much insulin
    - b. too little insulin
    - c. too much food
    - d. too little exercise

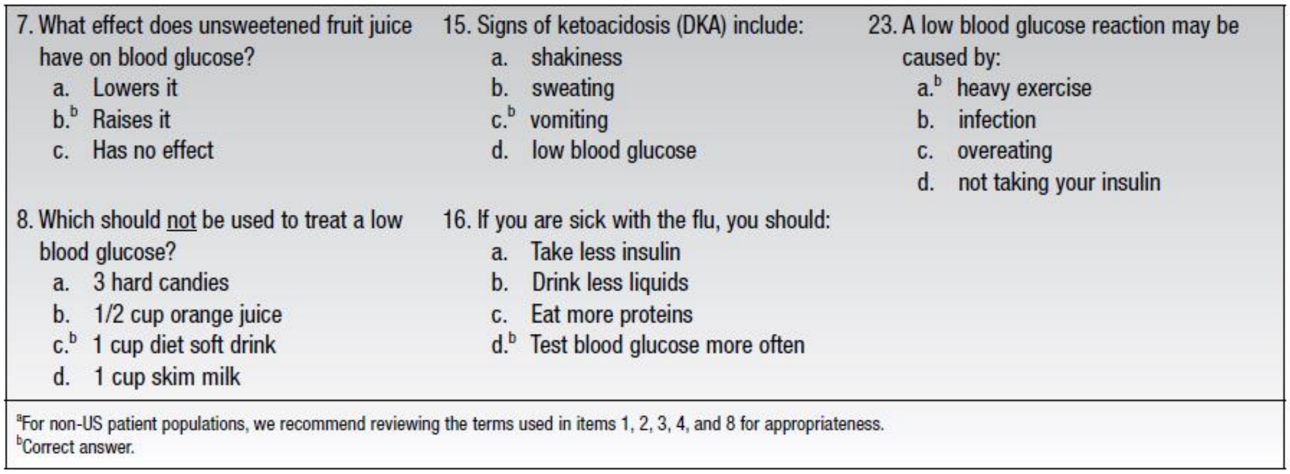
21. If you take your morning insulin but skip breakfast, your blood glucose level will usually:
    - a. increase
    - b.[b] decrease
    - c. remain the same

22. High blood glucose may be caused by:
    - a.[b] not enough insulin
    - b. skipping meals
    - c. delaying your snack
    - d. skipping your exercise

(continued)

(Fitzgerald et al., 2016)

Diabetes Knowledge Test (continues)



7. What effect does unsweetened fruit juice have on blood glucose?
   - a. Lowers it
   - b.[b] Raises it
   - c. Has no effect

8. Which should not be used to treat a low blood glucose?
   - a. 3 hard candies
   - b. 1/2 cup orange juice
   - c.[b] 1 cup diet soft drink
   - d. 1 cup skim milk

15. Signs of ketoacidosis (DKA) include:
   - a. shakiness
   - b. sweating
   - c.[b] vomiting
   - d. low blood glucose

16. If you are sick with the flu, you should:
   - a. Take less insulin
   - b. Drink less liquids
   - c. Eat more proteins
   - d.[b] Test blood glucose more often

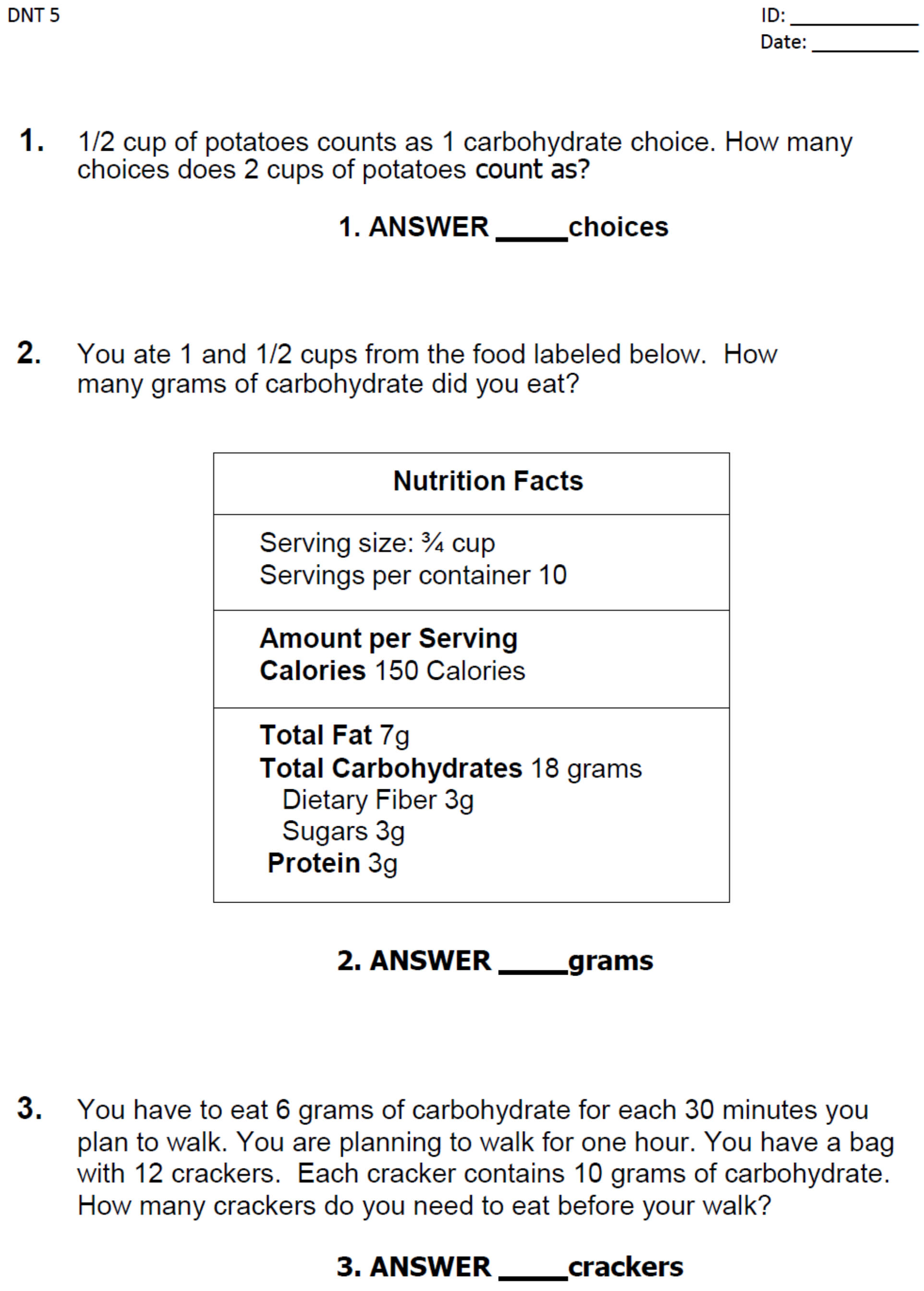
23. A low blood glucose reaction may be caused by:
   - a.[b] heavy exercise
   - b. infection
   - c. overeating
   - d. not taking your insulin

[a] For non-US patient populations, we recommend reviewing the terms used in items 1, 2, 3, 4, and 8 for appropriateness.

[b] Correct answer.

(Fitzgerald et al., 2016)

Diabetes Numeracy Test - 5



DNT 5

ID: ___________
Date: __________

1. 1/2 cup of potatoes counts as 1 carbohydrate choice. How many choices does 2 cups of potatoes count as?

1. ANSWER _____choices

2. You ate 1 and 1/2 cups from the food labeled below. How many grams of carbohydrate did you eat?

Nutrition Facts

Serving size: ¾ cup
Servings per container 10

Amount per Serving
Calories 150 Calories

Total Fat 7g
Total Carbohydrates 18 grams
Dietary Fiber 3g
Sugars 3g
Protein 3g

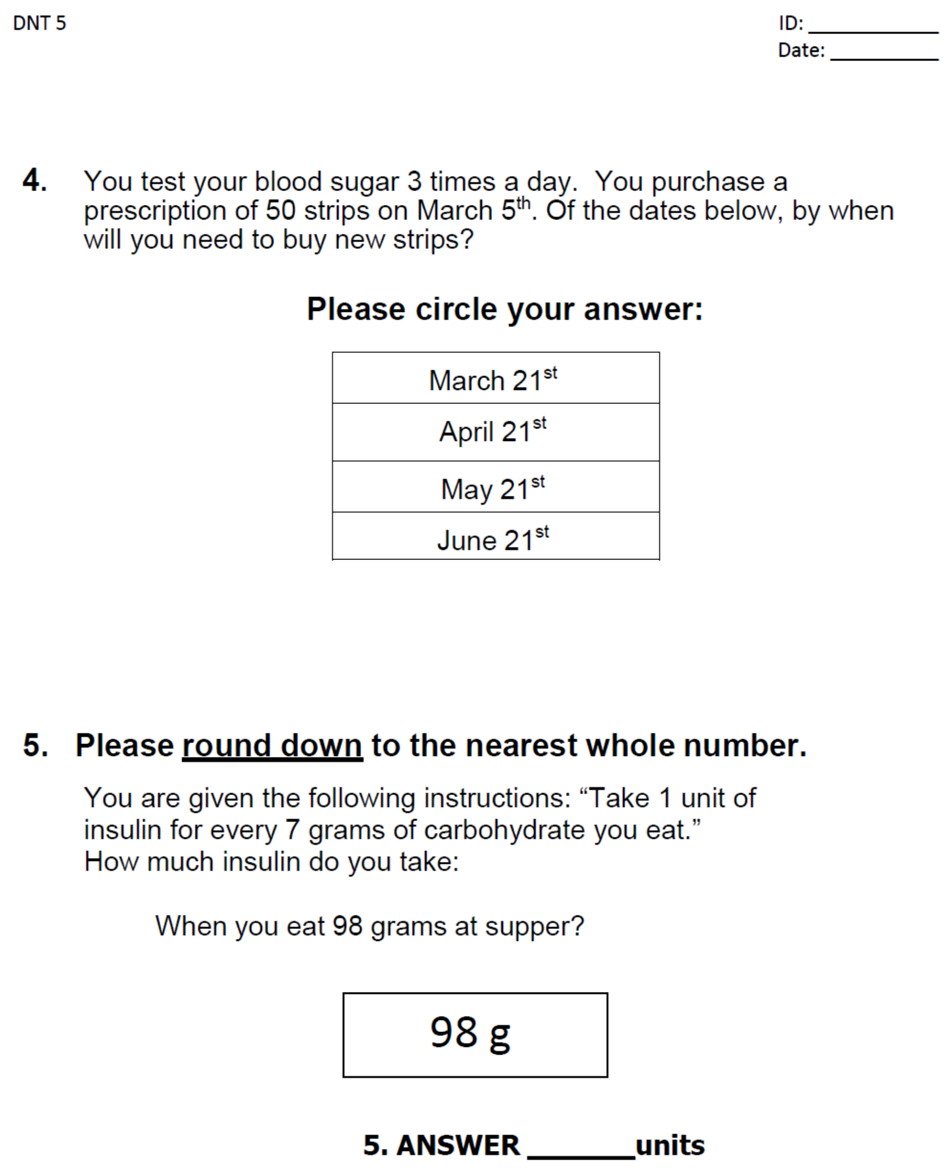
2. ANSWER _____grams

3. You have to eat 6 grams of carbohydrate for each 30 minutes you plan to walk. You are planning to walk for one hour. You have a bag with 12 crackers. Each cracker contains 10 grams of carbohydrate. How many crackers do you need to eat before your walk?

3. ANSWER _____crackers

(Vanderbilt University, 2011)

Diabetes Numeracy Test - 5 (continues)



DNT 5

ID: ___________

Date: __________

4. You test your blood sugar 3 times a day. You purchase a prescription of 50 strips on March 5th. Of the dates below, by when will you need to buy new strips?

Please circle your answer:

March 21st
April 21st
May 21st
June 21st

5. Please round down to the nearest whole number.

You are given the following instructions: “Take 1 unit of insulin for every 7 grams of carbohydrate you eat.”
How much insulin do you take:

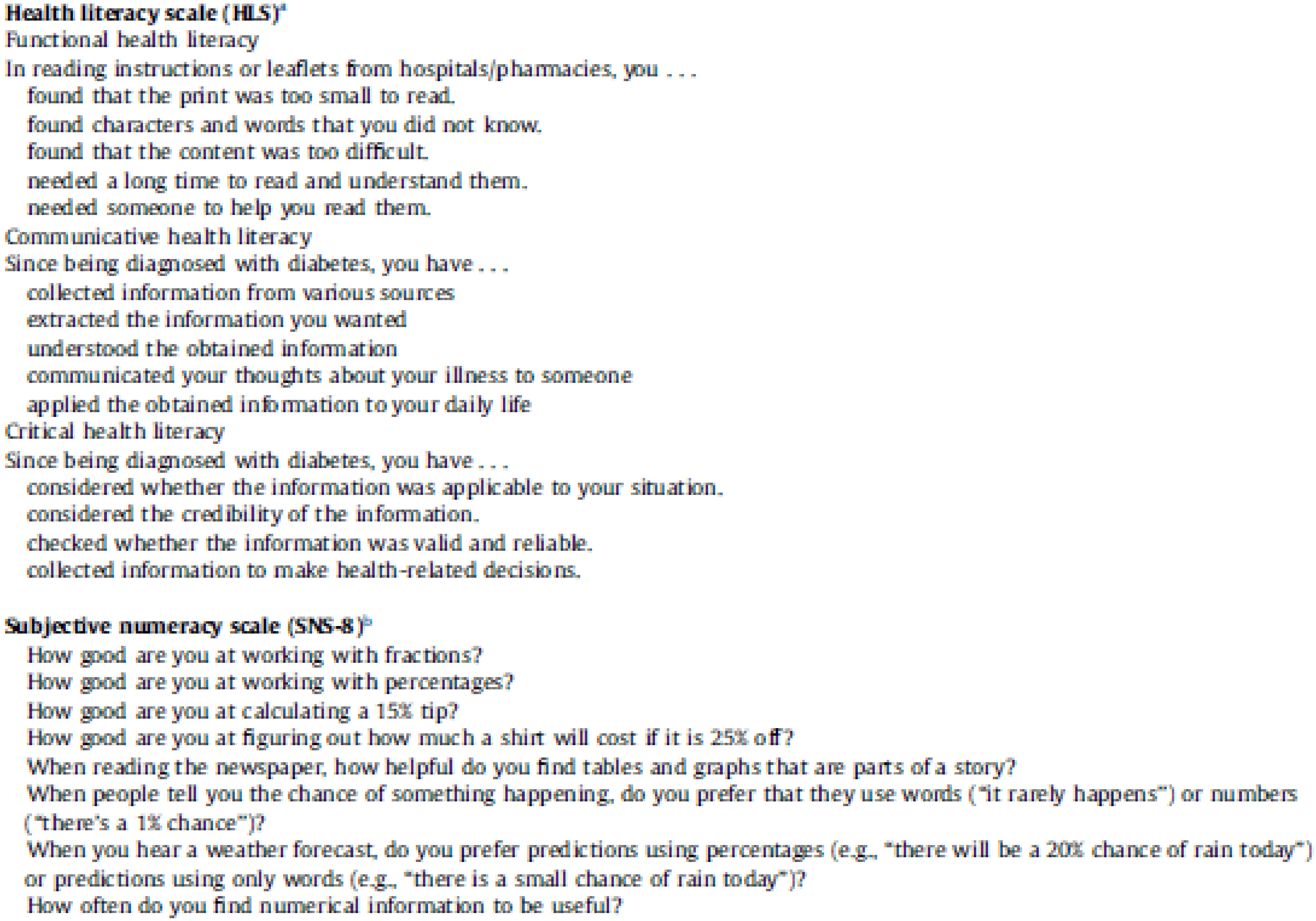
When you eat 98 grams at supper?

98 g

5. ANSWER _______units

(Vanderbilt University, 2011)

Health Literacy Scale and the Subjective Numeracy Scale



Health literacy scale (HLS)[a]

Functional health literacy

In reading instructions or leaflets from hospitals/pharmacies, you . . .

- found that the print was too small to read.
- found characters and words that you did not know.
- found that the content was too difficult.
- needed a long time to read and understand them.
- needed someone to help you read them.

Communicative health literacy

Since being diagnosed with diabetes, you have . . .

- collected information from various sources
- extracted the information you wanted
- understood the obtained information
- communicated your thoughts about your illness to someone
- applied the obtained information to your daily life

Critical health literacy

Since being diagnosed with diabetes, you have . . .

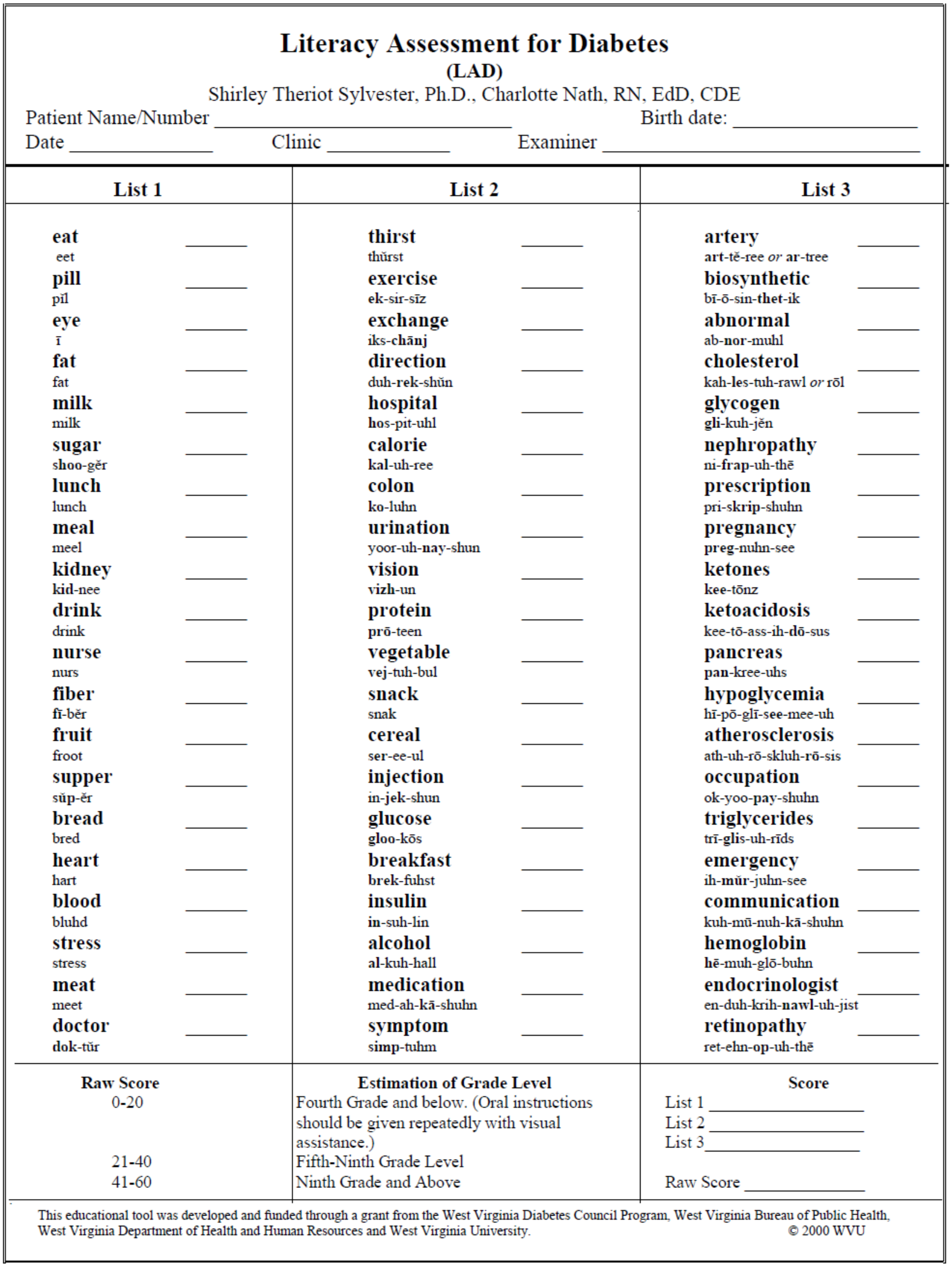
- considered whether the information was applicable to your situation.
- considered the credibility of the information.
- checked whether the information was valid and reliable.
- collected information to make health-related decisions.

Subjective numeracy scale (SNS-8)[b]

- How good are you at working with fractions?
- How good are you at working with percentages?
- How good are you at calculating a 15% tip?
- How good are you at figuring out how much a shirt will cost if it is 25% off?
- When reading the newspaper, how helpful do you find tables and graphs that are parts of a story?
- When people tell you the chance of something happening, do you prefer that they use words ("it rarely happens") or numbers ("there's a 1% chance")?
- When you hear a weather forecast, do you prefer predictions using percentages (e.g., "there will be a 20% chance of rain today") or predictions using only words (e.g., "there is a small chance of rain today")?
- How often do you find numerical information to be useful?

(Fagerlin et al., 2007; Ishikawa et al., 2008; Luo et al., 2018)

Literacy Assessment For Diabetes



Literacy Assessment for Diabetes

(LAD)

Shirley Theriot Sylvester, Ph.D., Charlotte Nath, RN, EdD, CDE

Patient Name/Number ______________________________ Birth date: __________________

Date ______________ Clinic ____________ Examiner ________________________________

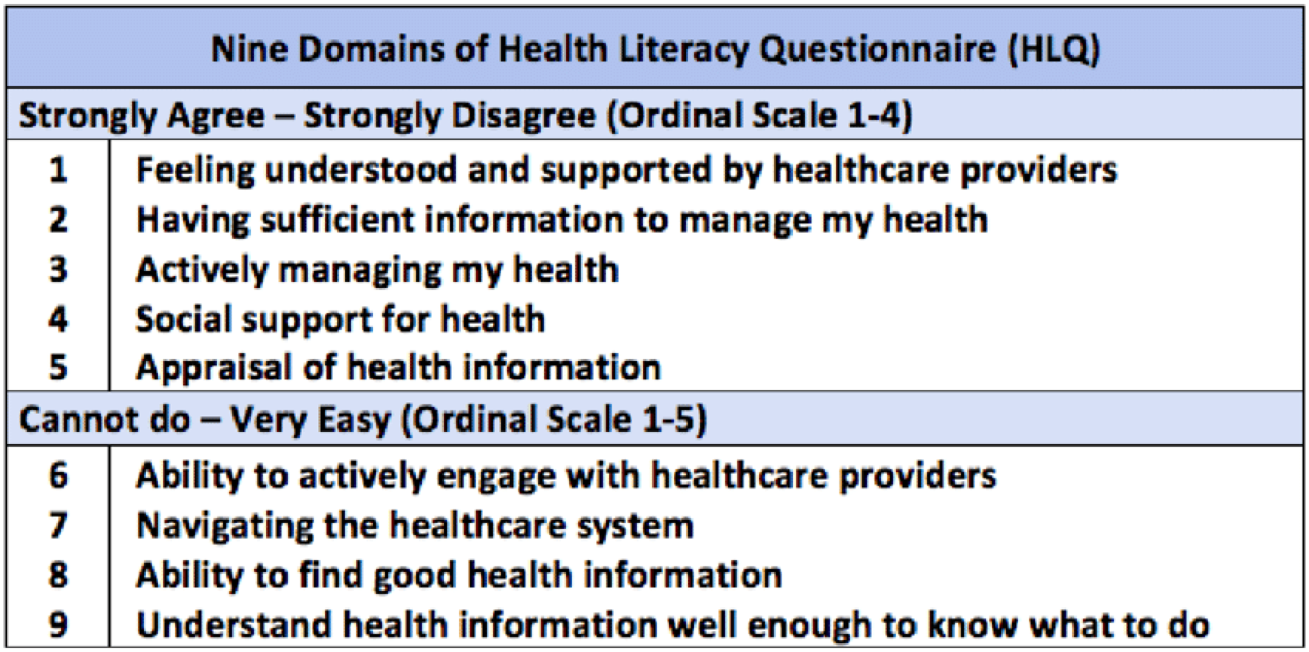
List 1		**List 2**		**List 3**	
eat eet	______	**thirst** thŭrst	______	**artery** art-tĕ-ree *or* ar-tree	______
pill pĭl	______	**exercise** ek-sir-sīz	______	**biosynthetic** bī-ō-sin-thet-ik	______
eye ī	______	**exchange** iks-chānj	______	**abnormal** ab-nor-muhl	______
fat fat	______	**direction** duh-rek-shŭn	______	**cholesterol** kah-les-tuh-rawl *or* rōl	______
milk milk	______	**hospital** hos-pit-uhl	______	**glycogen** gli-kuh-jĕn	______
sugar shoo-gĕr	______	**calorie** kal-uh-ree	______	**nephropathy** ni-frap-uh-thē	______
lunch lunch	______	**colon** ko-luhn	______	**prescription** pri-skrip-shuhn	______
meal meel	______	**urination** yoor-uh-nay-shun	______	**pregnancy** preg-nuhn-see	______
kidney kid-nee	______	**vision** vizh-un	______	**ketones** kee-tōnz	______
drink drink	______	**protein** prō-teen	______	**ketoacidosis** kee-tō-ass-ih-dō-sus	______
nurse nurs	______	**vegetable** vej-tuh-bul	______	**pancreas** pan-kree-uhs	______
fiber fī-bĕr	______	**snack** snak	______	**hypoglycemia** hī-pō-glī-see-mee-uh	______
fruit froot	______	**cereal** ser-ee-ul	______	**atherosclerosis** ath-uh-rō-skluh-rō-sis	______
supper sŭp-ĕr	______	**injection** in-jek-shun	______	**occupation** ok-yoo-pay-shuhn	______
bread bred	______	**glucose** gloo-kōs	______	**triglycerides** trī-glis-uh-rīds	______
heart hart	______	**breakfast** brek-fuhst	______	**emergency** ih-mŭr-juhn-see	______
blood bluhd	______	**insulin** in-suh-lin	______	**communication** kuh-mū-nuh-kā-shuhn	______
stress stress	______	**alcohol** al-kuh-hall	______	**hemoglobin** hē-muh-glō-buhn	______
meat meet	______	**medication** med-ah-kā-shuhn	______	**endocrinologist** en-duh-krih-nawl-uh-jist	______
doctor dok-tŭr	______	**symptom** simp-tuhm	______	**retinopathy** ret-ehn-op-uh-thē	______

Raw Score	**Estimation of Grade Level**	**Score**
0-20	Fourth Grade and below. (Oral instructions should be given repeatedly with visual assistance.)	List 1 ________________ List 2 ________________ List 3________________
21-40	Fifth-Ninth Grade Level	
41-60	Ninth Grade and Above	Raw Score _____________

This educational tool was developed and funded through a grant from the West Virginia Diabetes Council Program, West Virginia Bureau of Public Health, West Virginia Department of Health and Human Resources and West Virginia University. © 2000 WVU

(West Virginia Diabetes Council Program, 2000)

Health Literacy Questionnaire (HLQ)



Nine Domains of Health Literacy Questionnaire (HLQ)	
Strongly Agree – Strongly Disagree (Ordinal Scale 1-4)	
1	Feeling understood and supported by healthcare providers
2	Having sufficient information to manage my health
3	Actively managing my health
4	Social support for health
5	Appraisal of health information
Cannot do – Very Easy (Ordinal Scale 1-5)	
6	Ability to actively engage with healthcare providers
7	Navigating the healthcare system
8	Ability to find good health information
9	Understand health information well enough to know what to do

(Osborne et al., 2013)

Nutrition Literacy Assessment Instrument

Subscale: Nutrition and Health

Directions: Please read the text below and answer the questions that follow.

...A healthy diet is high in ***nutrient-dense*** foods, such as fruits, vegetables, and whole grains. A healthy diet is also low in ***energy-dense*** foods, refined grains, and added sugars. While these foods can provide energy, too much energy can lead to weight gain and chronic disease.

In order to follow a healthy diet, ***eat more:***

- **Nutrient-dense foods:** Fruits and vegetables are examples of *nutrient-dense* foods. Plant foods are *nutrient-dense* because they provide many vitamins, minerals, and other needed nutrients. At the same time, they are low in calories. Eating more of these foods may improve weight control and decrease disease risk....[Excerpt]

Directions: Choose the best answer for the questions below. You may go back to the text to choose your answers.

Nutrient dense foods, such as __________ should be consumed most often.

A. regular soda B. French fries C. an orange D. apple juice

Subscale: Energy Sources in Food:

These questions concern carbohydrate, protein and fat, the nutrients that supply energy to the body. **Directions:** Use what you know about nutrition to answer the following questions.

The calories in foods like olive oil and butter come from their high ________ content.

A. vitamin E B. carbohydrate C. protein D. fat

Subscale: Household Food Measurement

Sometimes we eat food in the right amounts as advised by nutrition experts and sometimes we choose smaller or larger portions than might be best to achieve a healthy diet. For each food in question, choose what you think is the right portion size. This portion may or may not be the amount you usually eat. The portion amounts given in the question are also shown in pictures.

3. Pictured at left is 1 (one) cup of rice. Is this:

A. more than one (1) portion?
B. less than one (1) portion?
C. about right for one (1) portion?

Subscale: Food Label and Numeracy

This Nutrition Facts Panel at right is taken from the back of a container of macaroni and cheese. How many grams of total carbohydrate would you eat in 2 cups of macaroni and cheese?

A. 31 grams
B. 45 grams
C. 62 grams
D. 75 grams

Nutrition Facts

Serving Size 1 cup (228g)
Servings Per Container about 2

Amount Per Serving

Calories 250 Calories from Fat 110

% Daily Value*

Total Fat 12g	**18%**
Saturated Fat 3g	**15%**
Trans Fat 3g	
Cholesterol 30mg	**10%**
Sodium 470mg	**20%**
Total Carbohydrate 31g	**10%**
Dietary Fiber 0g	0%
Sugars 5g	
Proteins 5g	
Vitamin A	4%
Vitamin C	2%
Calcium	20%
Iron	4%

* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

For educational purposes only. This label does not meet the labeling requirements described in 21 CFR 101.9.

Subscale: Food Groups

The next group of questions will give you a type of food and ask you to select the food group in which it belongs according to its nutrition value. For example, bread would be put into the grains group.

In which food group do noodles belong?

A. Grains B. Vegetables C. Fruits D. Protein E. Dairy F. Fats & Oils G. Added Sugars

Subscale: Consumer Skills

Directions: Choose the best answer for the questions that follow.

If calories are equal for one serving of each food, which provides the most healthful nutrients overall?

A. Applesauce with no sugar added
B. Apple
C. Applesauce with no sugar added is equal to an apple in nutrition.

Applesauce with no sugar added

Apple

(Gibbs et al., 2018)

Appendix C

Invitation to Participate

Development of a Health Literacy Tool to Support Certified Diabetes Educators during Virtual Visits with Clients

August 30, 2022

Principal Investigator (Researcher):
Nazli Parast
nparast1@athabasca.edu

Supervisor:
Pamela Walsh
pamelaw@athabascau.ca

My name is Nazli Parast and I am studying Doctorate of Education at Athabasca University. As a requirement to complete my degree, I am conducting a research project about development of a health literacy tool to support certified diabetes educators during virtual visits with clients. I am conducting this project under the supervision of Dr. Pamela Walsh.

I invite you to participate in this project because you are a Certified Diabetes Educator at Community Diabetes Education Program of Ottawa (CDEPO) and can provide valuable insight as a healthcare provider practicing activity in diabetes management.

The purpose of this research project is to improve healthcare providers' understanding of the health literacy of clients with diabetes during virtual visits.

Your participation in this project would involve providing me with your comments regarding existing health literacy tools via email and through focus group that will be done via Zoom. After I develop a new or modified diabetes health literacy tool, you can provide me comments about the tool to help to improve the tool. Then, use the tool in practice setting and provide feedback via survey and focus group. Your participation will take 2-3 hours between August 2022 - December 2022. The draft of the survey is not currently available because it will depend on the tool that will be developed/modified. Before you enter the Zoom at each focus group, you will change your name to CDE and turn off your camera.

All the information you will provide during the study will be stored by me in a password-protected USB drive. I will transcribe the meeting recording right after each focus group. The transcribed information, meeting minutes and survey results will all be stored in the USB drive. You will remain anonymous in all the data that I will be refer to in my dissertation. Your participation is voluntary and you can withdraw at any point during the study. Your data can be withdrawn if requested, within two weeks of the focus groups.

The research should benefit from your expertise as it may lead to the development of knowledge and a change in practice. I do not anticipate you will face any risks as a result of participating in this research.

Thank you for considering this invitation. If you have any questions or would like more information, please contact me, (the principal investigator) by e-mail nparast1@athabasca.edu or my supervisor by email pamelaw@athabascau.ca.

Thank you.
Nazli Parast, RN, CDE

This project has been reviewed by the Athabasca University Research Ethics Board. Should you have any comments or concerns about your treatment as a participant, the research, or ethical review processes, please contact the Research Ethics Officer by e-mail at rebsec@athabascau.ca or by telephone at 780.213.2033.

Appendix D

Participant Consent Form

Development of a Health Literacy Tool to Support Certified Diabetes Educators during Virtual Visits With Clients

Principal Investigator (Researcher):	**Supervisor:**
Nazli Parast	Pamela Walsh
nparast1@athabasca.edu	pamelaw@athabascau.ca

You are invited to participate in a research study about improving diabetes virtual visit through health literacy assessment. I am conducting this study as a requirement to complete my Doctorate of Education at Athabasca University.

Your participation in this project would involve providing me with your comments regarding existing health literacy tools via email and through focus group that will be done via Zoom. After I develop a new or modified diabetes health literacy tool, you can provide me comments about the tool to help to improve the tool. Then, use the tool in practice setting and provide feedback via survey and focus group. Your participation will take 2-3 hours between August 2022 - December 2022. The draft of the survey is not currently available because it will depend on the tool that will be developed/modified. Before you enter the Zoom at each focus group, you will change your name to CDE and turn off your camera.

Involvement in this study is entirely voluntary and you may refuse to answer any questions or to share information that you are not comfortable sharing. You may withdraw from the study at any time during the data collection period by contacting myself via email and I will permanently delete your data.

All the information you will provide during the study will be stored by me in a password-protected USB drive. I will transcribe the meeting recording right after each focus group. The transcribed information, meeting minutes and survey results will all be stored in the USB drive. You will remain anonymous in all the data that I will be refer to in my dissertation. Your participation is voluntary and you can withdraw at any point during the study. Your data can be withdrawn if requested, within two weeks of the focus groups.

Results of this study will be disseminated in my dissertation as well as future conferences and maybe publications but all participants will remain anonymous.

If you have any questions about this study or require further information, please contact myself, Nazli Parast (principal researcher) using the contact information above.

This project has been reviewed by the Athabasca University Research Ethics Board. Should you have any comments or concerns about your treatment as a participant, the

research, or ethical review processes, please contact the Research Ethics Officer by e-mail at rebsec@athabascau.ca or by telephone at 780.213.2033.

Thank you for your assistance in this project.

CONSENT:

I have read the Letter of Information regarding this research study, and all of my questions have been answered to my satisfaction. I will keep a copy of this letter for my records.

My signature below confirms that:

- I understand the expectations and requirements of my participation in the research;
- I understand the provisions around confidentiality and anonymity;
- I understand that my participation is voluntary, and that I am free to withdraw at any time with no negative consequences;
- I am aware that I may contact the researcher, *research supervisor*, or the Research Ethics Officer if I have any questions, concerns or complaints about the research procedures or ethical approval processes.
- I understand that the data I provide will be anonymized and that data set (or sets) from this project will be disseminated in researcher's dissertation as well as future conferences and may be publications but I will remain anonymous.
- I understand that the data will be stored in researcher's personal password-protected USB drive.

Name: ____

Date: ______________________________

Signature: ____

By initialing the statement(s) below,

______ I acknowledge that the researcher may use specific quotations of mine, without identifying me

______ I am granting permission for the researcher to use clips or excerpts in dissemination of the research

Appendix E

Email to Invite to Provide Instruction for Focus Group

Dear Colleague,

Thank you for accepting to participate in my research study. I would like to invite you to the focus group scheduled for August 31, 2022 at 6:00pm.

I would like to ask you to review the existing health literacy tools and send me your comments prior to the focus group.

Please let me:

What are you thoughts on the existing health liteacry tools?

What are the pros and cons of the tools?

Would you be able to use any of the tools in your practice setting? Which ones? Why?

You can further expand on your thoughts and answers during the focus group.

I look foward to hear from you and appreciate your time.

Regards,

Nazli Parast, RN, CDE

Appendix F

Post-Assessment Survey

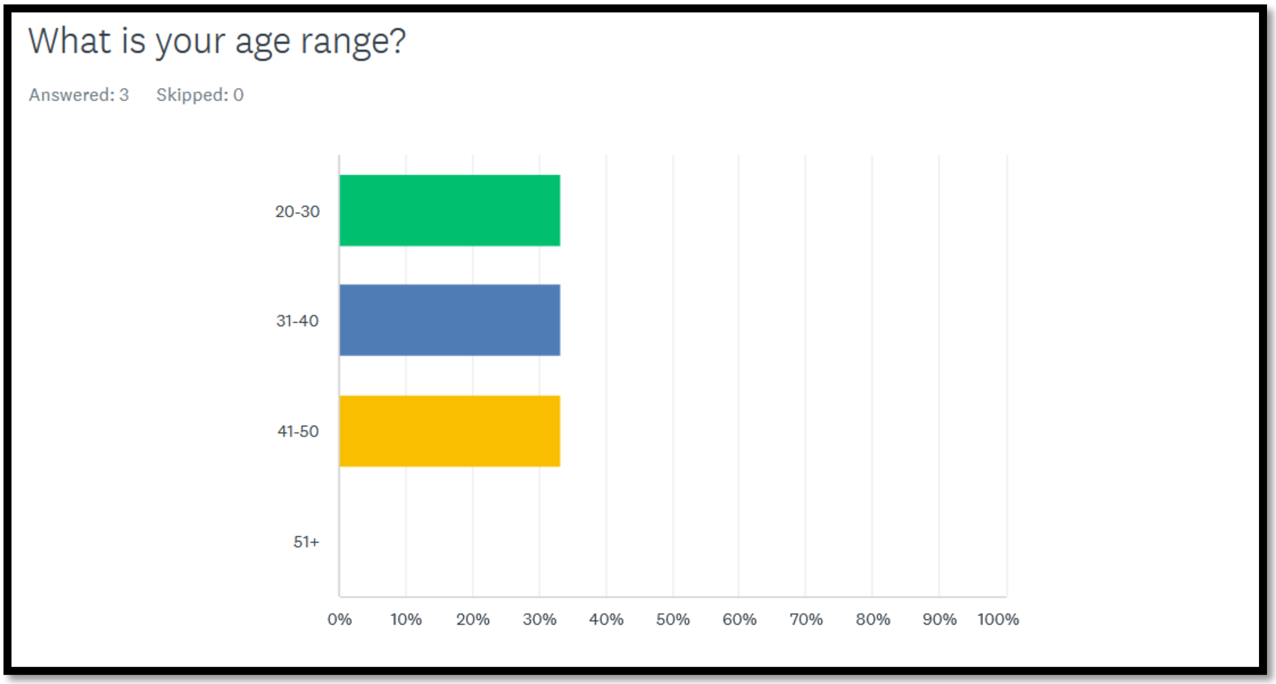
1. What is your age range?
    a) 20-30
    b) 31-40
    c) 41-50
    d) 51+
2. What is your profession?
    a) RN
    b) RD
3. How useful did you find the health literacy tool?
    a) Very helpful
    b) Helpful
    c) Neutral
    d) Unhelpful
    e) Very unhelpful
4. How did you find the tool in helping you to assess your client's health literacy?
    a) Very helpful
    b) Helpful
    c) Neutral
    d) Unhelpful
    e) Very unhelpful
5. How did your clients feel about the tool?

   a) Very helpful
   b) Helpful
   c) Neutral
   d) Unhelpful
   e) Very unhelpful

6. Were the subjective questions helpful?
   a) Very helpful
   b) Helpful
   c) Neutral
   d) Unhelpful
   e) Very unhelpful
7. Were the objective questions helpful?
   a) Very helpful
   b) Helpful
   c) Neutral
   d) Unhelpful
   e) Very unhelpful
8. Was the length of the tool appropriate?
   a) Very helpful
   b) Helpful
   c) Neutral
   d) Unhelpful
   e) Very unhelpful

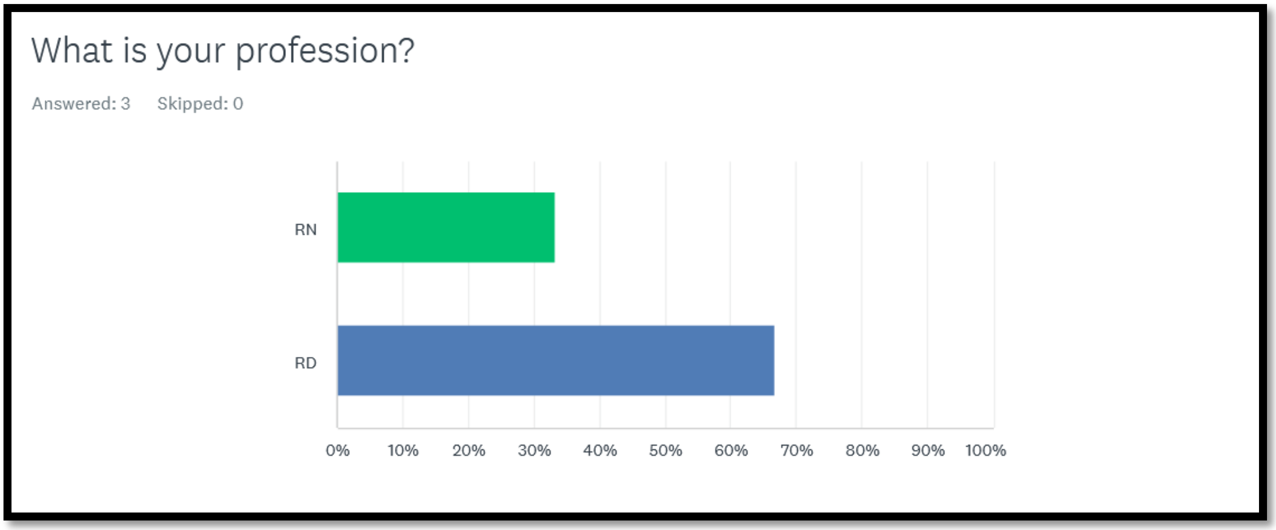
Appendix G

Post-Assessment Survey Results



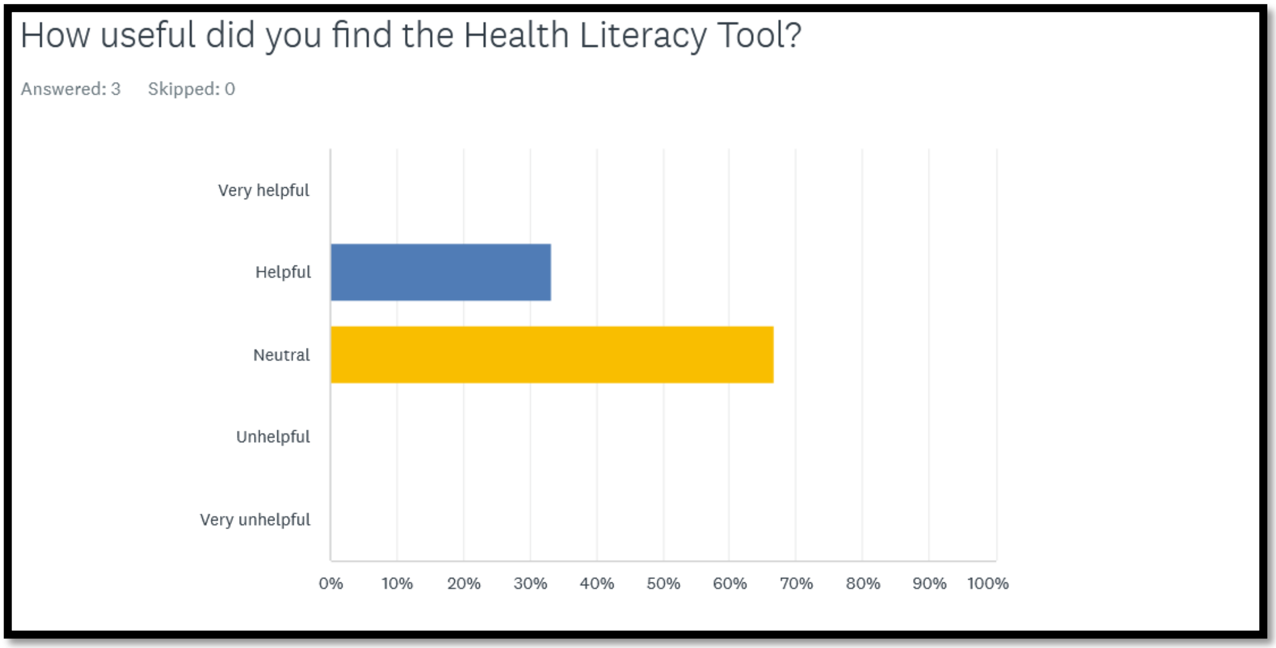
What is your age range?

Answered: 3 Skipped: 0



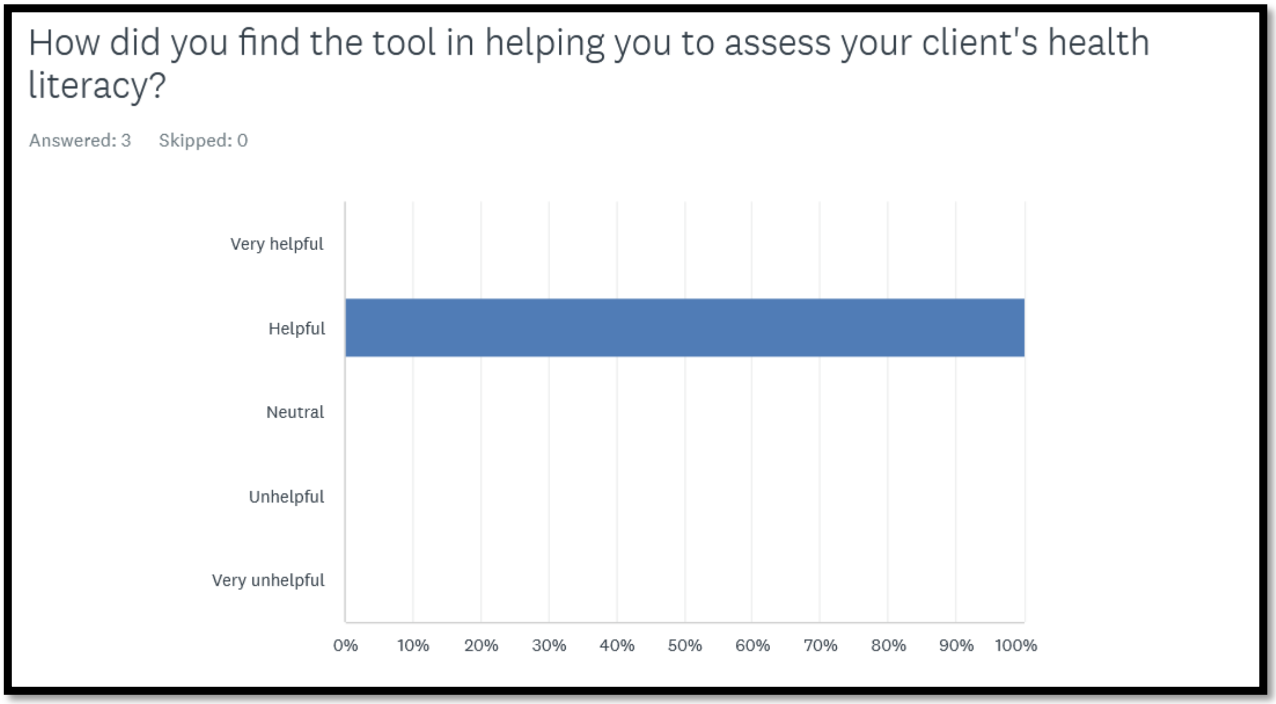
What is your profession?

Answered: 3 Skipped: 0



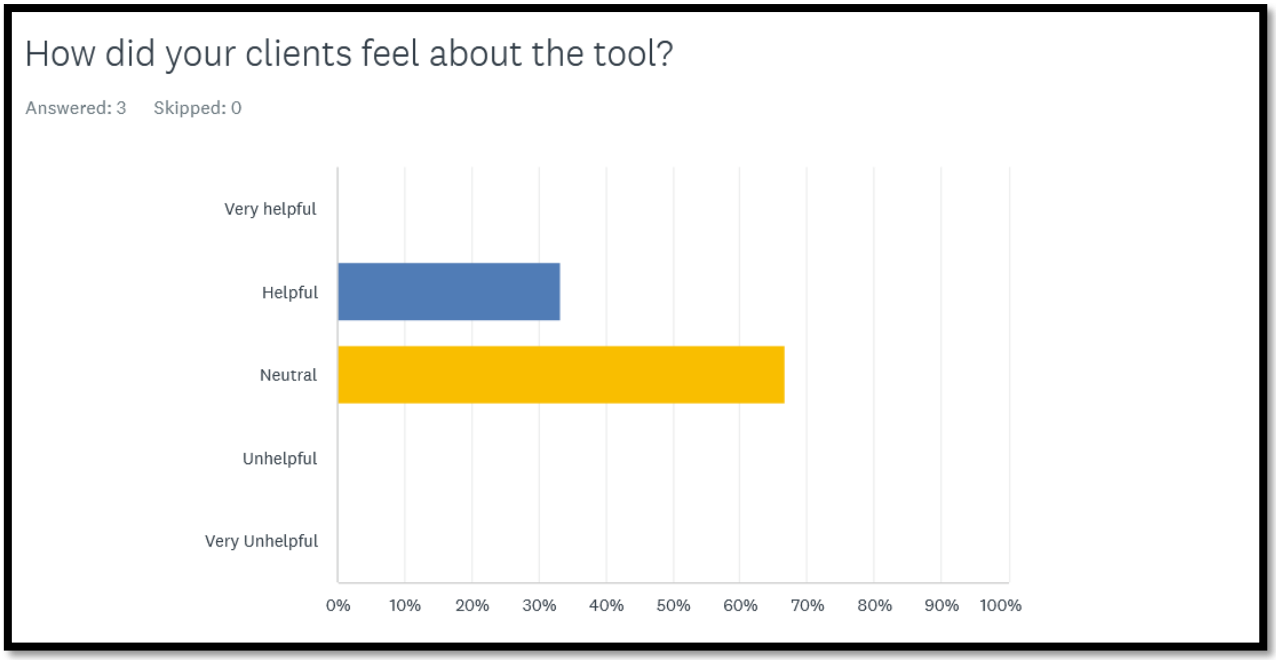
How useful did you find the Health Literacy Tool?

Answered: 3 Skipped: 0



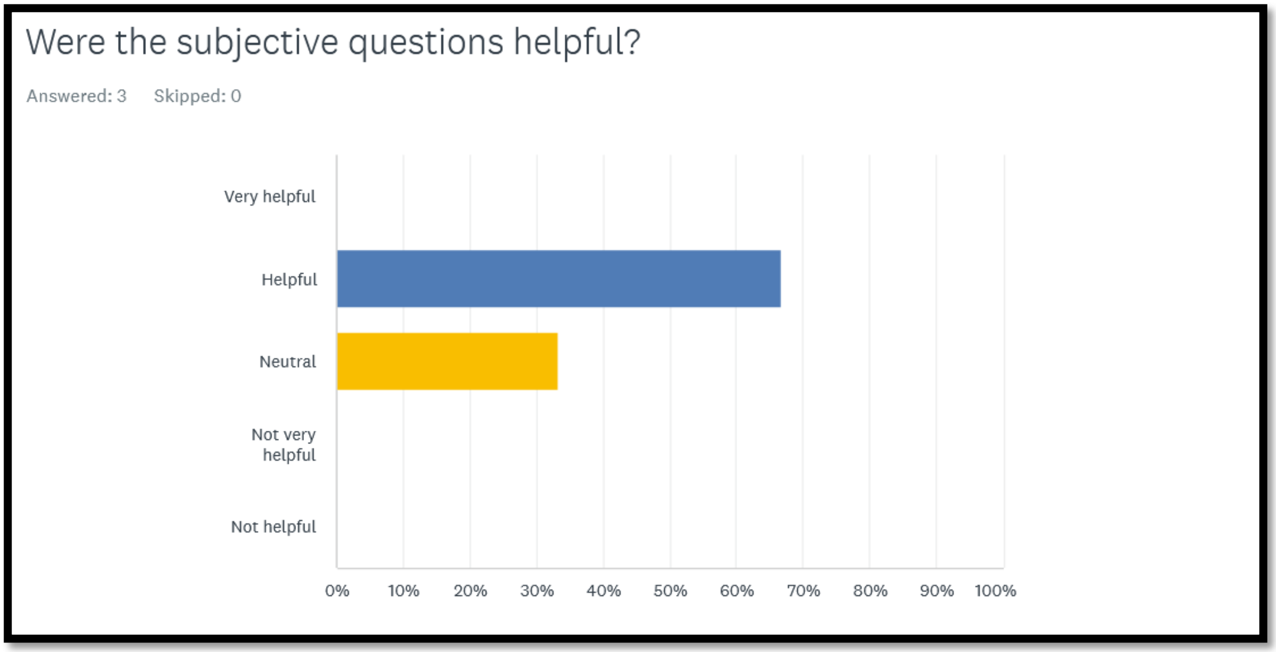
How did you find the tool in helping you to assess your client's health literacy?

Answered: 3 Skipped: 0



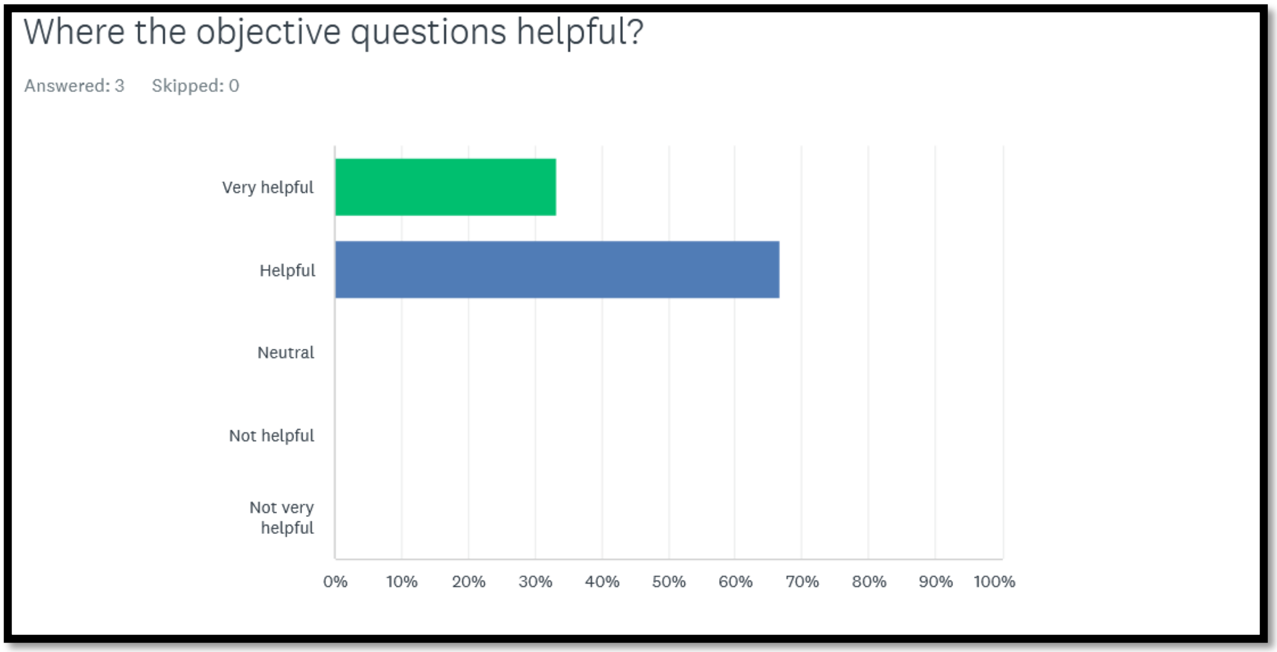
How did your clients feel about the tool?

Answered: 3   Skipped: 0



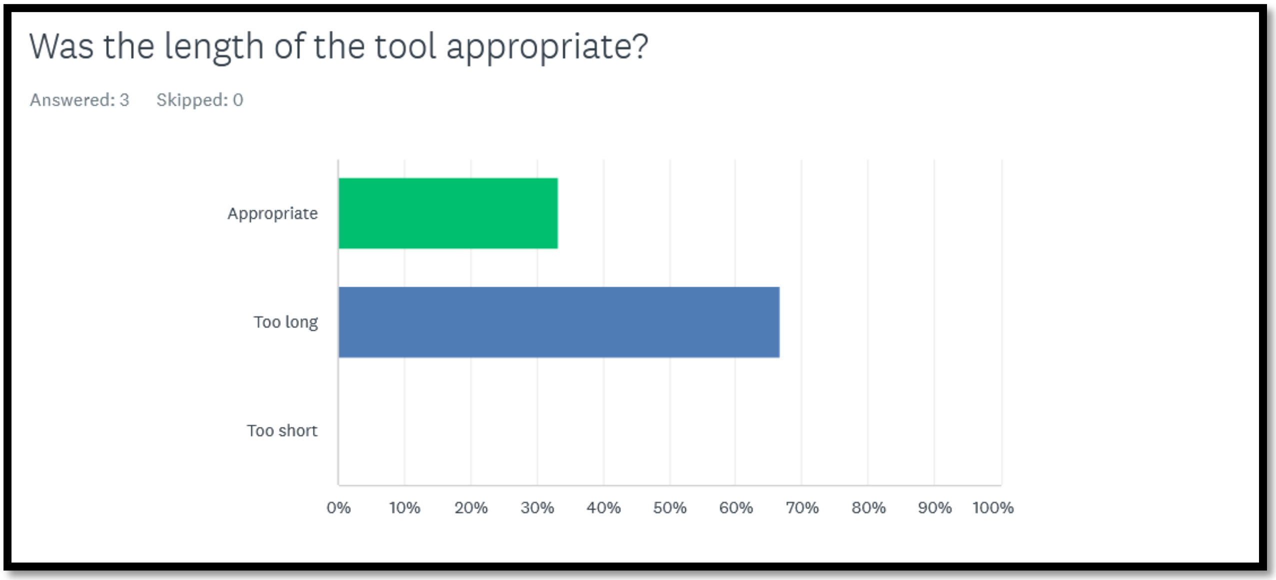
Were the subjective questions helpful?

Answered: 3   Skipped: 0



Where the objective questions helpful?

Answered: 3 Skipped: 0



Was the length of the tool appropriate?

Answered: 3 Skipped: 0