Improving Diabetes Self-Management in Māori Communities:

The Use of Behaviour Skills Training with Continuous Glucose Monitoring.

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Abstract

Diabetes mellitus is a chronic health condition characterised by irregularities in the production and processing of insulin. Within the New Zealand context, diabetes disproportionately affects the Māori population more than non-Māori. Self-management of diabetes relies heavily on individual behaviours to manage the condition, which can be challenging for individuals to effectively achieve on a daily basis. Due to the higher proportion of Māori who suffer from diabetes, there is a need for culturally tailored and effective interventions to support diabetes self-management. This aim of this study was to evaluate the effectiveness of behaviour skills training (BST) to improve diabetes self-management behaviours for two Māori participants who use continuous glucose monitoring (CGM) devices. The study integrated an applied behaviour analysis (ABA) intervention in BST and a Kaupapa Māori approach where tikanga Māori was weaved into the four components of BST. A task analysis was curated to score the correct procedure of applying a CGM device, with the goal of improving the participants self-management and overall health, aiming toward an improved quality of life. BST combined with a Kaupapa Māori approach was an effective tool for improving diabetes self-management for Māori participants who use CGM, highlighting the need for culturally responsive interventions in healthcare as well as acknowledging the effectiveness of a behavioural approach to medicine.

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I'd like to share a Whakataukī which guided me through this research: "Nāu te rourou, nāku the rourou, ka ora ai te iwi" - *with your food basket and my food basket, the people will thrive.* I resonate with this whakataukī as it highlights collective contribution and collaboration, reflecting mine, participants, supervisors, and the wider community working together to improve health outcomes.

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GLOSSARY OF TERMS FROM MĀORI TO ENGLISH

Māori Term	English Translation	Context in Thesis
Whanaungatanga	Relationship building, kinship	Foundation of researcher-participant trust
Tino Rangatiratanga	Self-determination, autonomy	Participants' control over their involvement
Manaakitanga	Care, hospitality, respect	Ethical treatment of participants
Kotahitanga	Unity, collaboration	Working alongside participants
Kanohi ki te kanohi	Face to face	In-person meetings
Tikanga	Customs, protocols	Culturally appropriate procedures
Koha	Gift, contribution	Thank-you gifts to participants
Tuakana/Teina	Older sibling/younger sibling	Peer learning relationship
Mana	Prestige, authority, spiritual power	Upholding participant dignity
Whānau	Extended family	Family context of health

Introduction

Diabetes Mellitus is a chronic medical condition characterised by an abnormal regulation of blood glucose levels due to impaired insulin secretion or not responding effectively to insulin. There are three main types of diabetes: Type 1 which is characterised by the pancreas not producing enough insulin, Type 2 which is characterised by the cells in the body becoming insulin resistant over time, and gestational diabetes which occurs during pregnancy (Roglic, 2016). Diabetes is a significant health concern in Aotearoa New Zealand (NZ), affecting over 300,000 New Zealander's (Te Whatu Ora, 2025). If not well managed or controlled, diabetes can lead to more severe health complications such as obesity, heart disease, kidney failure, vision damage, neuropathy, and in severe cases may lead to limb amputation (Egan & Dineen, 2022). Type 2 diabetes accounts for the majority of these cases. In order to effectively manage diabetes, health professionals suggest lifestyle changes such as a healthy diet, increased physical activity, regular blood sugar monitoring, and health checkups, as well as the use of medication (Diabetes New Zealand, 2025).

The burden of diabetes, however, is not evenly distributed within the population. In Aotearoa NZ, the Māori community, in particular, are overrepresented in the diagnosis of diabetes and several other health conditions compared to non-Māori (Reed, 2025). Other health conditions include a range of cancers, respiratory illnesses, cardiovascular diseases, and organ failure (Te Whatu Ora, 2025). Māori are two times more likely to be diagnosed with diabetes than non-Māori and often suffer from higher rates of diabetes-related complications and mortality (Beaton et al, 2019). These disparities can be explained by a range of socio-economic, systemic, and historical barriers such as inequities in health education, limited or no access to culturally tailored treatments, and generational trauma due to colonisation (Reed, 2025). As a result of some of these factors, Māori are less likely to trust medical professionals due to generational distrust in the healthcare system, stemming from previous post-colonisation mistreatment. These barriers and mistrust highlight the need for Māori to have access to unique, culturally tailored forms of healthcare and treatments in order to be afforded equal opportunity to achieve successful outcomes (Tane et al, 2021).

Diabetes self-management behaviours play a central role in a patient's diabetes management overall (McSharry et al, 2020). There are many ways in which patients are responsible for their own self-management, for example, routine blood glucose monitoring, medication administration and monitoring, dietary changes, exercise, and many more

(Harvey & Lawson, 2009). Although the importance of these self-management behaviours is explained by health professionals and is assumed to be understood by patients, these behaviours are often not achieved or avoided (Harvey & Lawson, 2009). Possible explanations for the avoidance of self-management behaviours could be due to a range of reasons, such as psychological, cognitive, cultural, social, or environmental barriers (Wagner et al, 2012). The rate of engaging in diabetes self-management behaviours is problematically low, with disorders related to mood, anxiety, and eating being higher in those with diabetes than those without it (Wagner et al, 2012), highlighting a need for intervention to make these behaviours more manageable and improve both care and quality of life for those with diabetes (McSharry et al, 2020).

Effective self-management of a chronic condition such as diabetes involves a complex and demanding daily schedule, consisting of a number of diabetes management behaviours. These include, but are not limited to, blood glucose monitoring via regular finger pricking (termed self-monitoring of blood glucose (SMBG), adherence to medication schedules, specific dietary requirements, and physical activity (Mertig, 2012). Typically, self-management can be both a mental and physical burden for those with diabetes. This is due to the time, energy, strict dietary restrictions, and major lifestyle adjustments necessary to keep one's diabetes well managed (Egan & Dineen, 2022), however, modern technology has made certain self-management tasks easier. For example, continuous glucose monitoring (CGM) is gradually replacing the need for manual SMBG (Janapala et al, 2019). CGM systems give individuals with diabetes access to real-time blood glucose data, and alert individuals when glucose levels are high or low and intervention is needed (Freestyle Libre, 2025). A CGM device consists of a sensor, transmitter, insulin pump, receiver, and specific subscriptions to phone applications (apps) which help to filter this information as feedback to the user. CGM operates by being inserted underneath the skin and transmitting information to the app for patients to access throughout the day/night (Freestyle Libre, 2025). CGM devices track the body's glucose levels in the interstitial fluid and offers real-time data during the day and night, helping to familiarise users with their glucose trends and improve overall diabetes self-management (Pharmac, 2025). The two most popular brands of CGM are Libre and Dexcom, which cost approximately $80-$120 every 10 days with some additional fees for app subscriptions. With growing competition in the CGM industry these may be projected to decrease.

Although seen as an extremely helpful tool, CGM presents a new range of challenges for patients. These include operation costs, difficulty for some patients in using the CGM apps, skin irritation and discomfort, social factors, and alarm or information fatigue (Hilliard et al, 2019). Stigma associated with diabetes and visible self-management technologies such as CGM devices that may be externally visible can negatively affect the psychological wellbeing of patients with diabetes. For example, some CGM users report feelings of insecurity, being judged, blamed, or treated differently due to the visibility of the CGM device and its public perception (Kim et al, 2026). While in many respects CGM offers easier self-management, barriers remain as to their use. In addition to the psychological impact mentioned above, patients are often not adequately trained to implement or use their CGM device (Tanenbaum et al. 2021; Heinemann et a. 2020; Evans et al. 2024). This highlights a need for a structured intervention to help train CGM use for diabetes self-management strategies to equip individuals with improved skills necessary to manage the demands of living with diabetes.

One field within psychology that can support skills training is applied behaviour analysis (ABA). Behaviour analysis (BA) is an evidence-based field of psychology that is focused on understanding behaviour and how it is affected by the environment (Rasmussen et al, 2022). ABA itself is the application of the principles of behaviour analysis, where behaviour analysis is often described as the ‘why’ to explaining behaviour, and ABA as the ‘how’ to modify behaviours (Rasmussen et al, 2022). BA has a historical relationship with health. Some areas where behaviour analysts have engaged in health research or implemented clinical treatments related to health issues are toilet training (Azrin & Foxx, 1971) including enuresis (William & Jackson, 2012), paediatric feeding disorders (Patel et al, 2002) and money counting skill acquisition in individuals with brain injury (Fienup et al, 2013). This research highlights a longstanding relationship between BA and research within the health field, combining evidence-based, scientific methods with practical applications to help improve an individual’s quality of life. BA works to identify the underlying causes of behaviour that may be acting as a barrier to health treatment or learning, and offers tailored programmes to create meaningful, positive change to an individual’s lifestyle (Cooper et al, 2020).

One principle within BA is positive reinforcement. Positive reinforcement describes a contingency where a positive consequence consistently follows a specific response or behaviour which results in an increased frequency of the response or behaviour occurring again in the future (Skinner, 1965). Positive reinforcement should form the cornerstone of training to teach new skills, increase positive behaviours, and decrease harmful behaviours (Cooper et al, 2020). ABA is designed to be individualised, and instead of forcing compliance, encourages collaboration with families to set goals and improve quality of life (Cooper et al, 2020).

Behaviour Skills Training (BST) is an evidence-based ABA intervention tool which is typically used to teach a skill in an organised manner and is often tailored to be specific to the individual and skill being taught. BST fundamentally evolved from the foundational principles of BA (Skinner, 1965) and is widely used within the ABA sector. For example, Quintero et al (2020) utilised BST to help reduce head injury in youth soccer, Vanselow and Hanley (2014) computerised BST to teach safety skills to youth, and DeCarli et al (2025) demonstrated its adaptiveness when applying BST via telehealth to help reduce child restraint systems misuse. When BST is conducted, it is typically accompanied by a task analysis, which is another evidence-based ABA practice. BST and task analysis function together to teach skills effectively, with the task analysis breaking the target skill down into smaller, more manageable steps, while BST provides a structured framework for the skill to be taught/mastered. For example, Quintero et al (2020) utilised a 14-step task analysis to help teach children the proper technique to header a soccer ball safely with the end goal of reducing head injuries. Breaking a skill down into simpler, manageable steps is important as it makes complicated tasks easier to complete and encourages the correct completion of the skills in its entirety, usually working towards a larger end goal.

Following development of a task analysis, BST consists of four primary components: instruction, modelling, rehearsal, and feedback, and can be used within a range of settings and behaviours. The instruction phase involves explaining the skill intended to teach or providing the participants with instruction on what to do. The explanation is clear and concise and helps to explain why a specific task is important to master. For example, Quintero et al (2020) began with verbal instruction, going over each step of their 14-step task analysis in detail. The modelling phase involves showing the participants exactly how the skill should be completed. This is important because it models to the participant that the skill is achievable and not something to avoid. For example, Quintero et al (2020) modelled the desired skill to their participants by demonstrating correct body positioning and ball to head contact while verbalising the technique to the players. The rehearsal phase involves a participant practicing the skill under supervision. Lastly, the feedback phase involves providing positive reinforcement, correction, and support to participants throughout the rehearsal phase in order to encourage the full completion of the skill. For example, Quintero et al (2020) provided praise of correct steps along with which steps were completed in error, followed by an explanation of how steps should be completed correctly to give participants a chance to rehearse the skill while addressing the corrective feedback.

While BA has a historical presence in the health field, as a field it has emerged from Western scientific paradigms. More recently, BA has recognised the importance of cultural resonance within practice, however, this is not routinely incorporated within behavioural approaches, despite the overwhelming evidence of its positive impact (Jimenez-Gomez & Beaulieu, 2022). Within the Aotearoa NZ context, a culturally adapted intervention ensures that the strategies within an approach reflect a Māori worldview, including Mātauranga Māori values and real-life experience (Goodwin & Boulton, 2024). This helps to encourage greater trust, rapport, engagement, and reliability of outcomes and feedback (Kidd et al, 2021). Interventions that fail to acknowledge one's cultural identity often risk reinforcing health inequities; however, those that consider the cultural impact and are co-designed within a Māori perspective encourage and promote confidence and self-determination (Crosswell et al, 2025). A Kaupapa Māori approach is therefore one that incorporates whānau support, communication skills that resonate with the Māori way of life and learning (and being aware of what to avoid) and incorporates health and wellbeing aspects of Te whare tapa whā to challenge colonial, Western-centric systems. These all work to gain trust and enhance the effectiveness of relationships (Rolleston, 2022) between the researcher or other professionals within the Māori community. Prioritising cultural responsiveness is important for health professionals to not only improve commitment to self-management behaviours and strategies while also contributing to reducing disparities in diabetes outcomes within the Māori community and even the non-Māori community (Tane et al, 2021).

A Kaupapa Māori research methodology centres a Māori worldview, knowledge, and experience (Smith, 2021), and decentres Western scientific paradigms. A Kaupapa Māori approach is more than just research focused on Māori. Instead, it challenges traditional colonial structures by operating research by, with, and for Māori, positioning Māori voices at the forefront rather than historical traditions where Māori were treated as objects of study instead of active, equal research partners (Walker et al, 2006). The current study weaves Kaupapa Māori principles through implementing Whanaungatanga (building/fostering genuine relationships and trust that goes beyond the research); Tino Rangatiratanga (ensuring participants retain self-determination and control over their involvement); Manaakitanga (upholding the mana of participants by remaining respectful and ensuring no harm is caused); Kotahitanga (working in unison with participants as partners within the research instead of subjects); Tikanga (observing culturally appropriate practices and creating culturally safe environments); and Kanohi ki te kanohi (face to face meetings). These principles are woven throughout the research design from pre-intervention to post-intervention.

Considering the importance of diabetes for Māori, this study investigates the effectiveness of BST to help support two Māori patients diagnosed with type 2 diabetes who currently use a CGM device. As BST is grounded in Western BA philosophy, a Kaupapa Māori co-design approach was utilised to weave the BA and Kaupapa Māori approaches together with the specific aim of benefiting Māori to support and improve diabetes self-management behaviours.

Method

Participants

Two Māori females diagnosed with diabetes and who use CGM participated in the study. Subject A, a 65-year-old female was diagnosed with type 2 diabetes in 2023 and had recently started using a CGM device in 2025 following access to funding. Subject B, a 58-year-old female, was diagnosed with type 2 diabetes in 2022 and had been using CGM for two years. Both participants were recruited through Primary Healthcare Limited (PHCL)/Pinnacle company group through an application process which was approved by the clinical director, and the clinical governance who oversee all requests through Pinnacle. Participants were identified and approached by a Pinnacle clinical pharmacist according to the following criteria: they were over the age of 18, identified as Māori, had a confirmed diagnosis of diabetes, and currently used a CGM device for diabetes management. Consent followed a two-step process. First, potential participants were provided with the study information by the clinical pharmacist and signed a consent form giving permission for the researcher to contact them. Second, a further consent form was provided where participants gave consent to the researcher to participate in the study.

Ethical Approval

Ethical approval for this study was granted by the Human Research Ethics Committee (HREC) of the University of Waikato (UoW) prior to the commencement of the study. The HREC reference assigned to the current study is HREC(Health)2025#26.

Materials and Setting

Task Analysis

A task analysis was curated by comparing and using aspects of two different CGM device brands, the Freestyle Libre 2 and Dexcom G7. A task analysis is a structured process that breaks down a complex skill or activity into smaller, more manageable steps to achieve a primary goal. Application instructions from the Freestyle Libre 2 and Dexcom G7 were analysed and formed the basis of a 15-step task analysis. The task analysis was reviewed by a Pinnacle Clinical Pharmacist who specialised in diabetes management and provided valuable feedback and insight on the necessary steps of CGM application and their appropriate order. Her insight was in alignment with the Libre and Dexcom instructions with the addition of a focus on ensuring the task analysis included all necessary steps and information to insert the CGM device safely and correctly. We then collaboratively created a final task analysis using the body of the Freestyle Libre 2 and Dexcom G7 application instructions, along with our own personal knowledge on what would be of most help for the specified participant group when considering Kaupapa Māori principles. The resulting 15-step task analysis was easy to follow, was devoid of clinical jargon, and only contained the information necessary for correct application. Table 1 displays the final task analysis for correct CGM application. Participants had to complete each step, 1 through to 15, as described. If a step was missed or performed incorrectly to what was described in Table 1, then it was scored as a zero/incomplete. If a step was completed correctly, it was scored as one point out of 15 total points.

Table 1.

Task Analysis for Correct Application of a CGM Device.

1. Read the device instructions (usually brand specific).
2. Inspect the CGM sensor kit and packaging to ensure the seal is intact, the expiry date is eligible, and that there is no major damage.
3. Set the applicator to the side of where you are working so it is safe, but easily accessible down the line.
4. Choose a sensor site on your body, usually on your upper abdomen or upper arm. Remember to avoid placing on scars, moles, irritated skin, areas that bend, or where clothes might rub often.
5. Rotate sensor sites and locations. If you've used a CGM device before, choose a different site from last time and record the site and date for the future.
6. Wash and dry your hands thoroughly using soap, water, and a clean towel. Steps 5-8 are important as you will be breaking the skin barrier applying the device and do not want to risk bacteria entering the site.
7. Disinfect the chosen site location with a disinfectant wipe (or alcohol wipe) by rubbing in a circular motion, then let the area air dry without touching.
8. If you have a history of sensitive skin, apply a skin barrier product and let it dry fully.
9. Once the site is cleaned and prepped, do not touch the area with fingers, hair, or clothing. If re-contaminated, you should re-clean the site.
10. Unscrew the cap from the application and set the cap to the side.
11. Relax the muscles in the site area.
12. To apply the sensor, press the applicator firmly on to your site of choice, and listen for the 'click' sound.
13. Once clicked and after about 3 seconds, slowly pull the applicator away parallel from the site.
14. To ensure your sensor is secure, press the top of the sensor for about 10 seconds, and rub firmly around the patch 2-3times.
15. Check the app on your phone or the receiver to finish the device setup.

Behaviour Skills Training

Behaviour skills training (BST) is a behavioural intervention consisting of four key components or phases: Instruction, Modelling, Rehearsal, and Feedback. BST is used to teach a skill in a structured manner, tailored to those in need of help learning a specific skill. To reflect a Kaupapa Māori framework, the key components of BST were adjusted slightly to acknowledge appropriate tikanga (protocols) and take time to establish whanaungatanga (building relationships). Whanaungatanga was of particular importance prior to the instruction phase to ensure genuine relationships, trust, and rapport were built to reflect genuine results. Tino Rangatiratanga (self-determination) was explained at the beginning of the process and re-visited throughout to ensure participants understood that they were in control of their experience with the study and were at any time able to express their needs and adapt the procedure to make them more comfortable. Manaakitanga was upheld by being respectful of everyone's different lived experiences, not expecting their journey with diabetes to be the same and treating each participant as an individual with their own autonomy, thoughts, and feelings to uplift their mana as individuals within this study.

Step-by-step Instruction Card

A step-by-step instruction card was created that provided a printed version of the task analysis for participants. This was printed on A4 paper and laminated as a material for the participants to refer to during the instruction, rehearsal, and post-intervention phases of BST. Participants were also gifted the instruction card as a koha (gift) at the end of the intervention so that it could be used to support their ongoing CGM use.

Continuous Glucose Monitoring Device

A CGM device is a diabetic self-management tool used to continuously track an individual's glucose levels throughout the day providing real-time data and alerting when these levels increase/decrease to the point of needing intervention (medication or sugar). The individual wears a CGM monitor which consists of a sensor which is inserted under the skin and feeds back data to the device's system app, typically connected to the user's smartphone. A CGM device lasts between 7-14 days depending on the brand and must be reapplied at the end of this period. The CGM devices that both participants wore were the freestyle libre brand.

Demographic/Health Survey

Upon first introduction and observing Kaupapa Māori protocols, each participant was presented with a short survey asking questions about their diabetes management, their CGM experience, and specifically, if there were any areas of self-management where they felt they needed additional support in CGM use. The survey consisted of four questions and can be seen in Table 2. An open-ended question was included in the survey to capture specific challenges (e.g., navigating the app, skin irritation, alert fatigue) of CGM use experienced by each participant. This allowed the intervention to be designed with and by the participants, respecting rangatiratanga and allowing the participants to have full autonomy and self-determination over their own experience throughout this research. Responses to this survey indicated that skin irritation was the biggest deterrent to using a CGM device for both participants. Skin irritation is an issue that stems from the CGM application itself.

Table 2.

Demographic/Health Survey Questions.

1. What year were you diagnosed with diabetes?
2. When did you first start using a CGM device for your self-management?
3. What areas of your diabetes self-management do you feel you could use more support with your CGM use?
4. Are there any barriers to using your CGM device for your self-management?

Dependent Variable

The primary dependent variable for this study was the percentage of correct steps performed on the 15-step task analysis of correct CGM application. If any part of a step was omitted or performed incorrectly (as indicated on Table 1), the step was scored as 'incorrect' and marked with a zero. For example, step 6 (wash and dry your hands thoroughly using soap, water, and a clean towel) was scored correctly if all three components were executed. If participants washed their hands with soap and water but did not use a clean towel to dry them (e.g. used their clothes or air dried), this step was marked as incorrect. Steps performed correctly were scored as one point, with 15 points total available. The percentage of correct steps executed was calculated by dividing the number of correctly performed steps by the total task analysis steps (15) and was then multiplied by 100.

General Procedure

First, Primary Healthcare Limited (PHCL) were approached for permission to source patients diagnosed with diabetes in the Waikato region. Permission was requested via a written application which included all study information such as the research question, the different elements of the research that involved patients directly, and the demographic characteristics of potential eligible participants. Once permission was granted, a Pinnacle clinical pharmacist was tasked with sourcing potential patients and providing them with a study information sheet containing the research information. If any potential participant expressed interest in participating, they were given the necessary study information and consent forms providing permission to be contacted by the university/researcher. Participants had to provide consent to be contacted by the researcher before any contact was made. Following this consent, the researcher contacted each participant via email and a second consent to participate in the study was obtained.

Following signed consent to participate, and observing Kaupapa Māori protocols, the researcher made initial phone contact with participants beginning with a mihi (brief introduction) acknowledging ties to the Waikato area and exchanging whakapapa connections. The purpose of this process was to build whanaungatanga and establish a good foundation for a relationship throughout the study. We then organised our first Kanohi ki te Kanohi (face to face) session in a location of the participants choosing (their own homes, marae, community setting etc) which began with a warm greeting and a brief hug if agreed upon (common tikanga within Māori), sharing of kai/tea (refreshments supplied by the researcher), informal conversation to strengthen rapport and connections, and an opening karakia (prayer) if the participant agreed. The researcher then explained all aspects of the research and what was required from each participant, giving them the opportunity to rescind their involvement at any moment if they chose. This helps to honour tino rangatiratanga (self-determination) by ensuring participants were fully informed, understood expectations, had a choice/say in research aspects, and felt comfortable and in control in an environment of their choosing. During this first session, participants were asked about their experience so far with using CGM to determine whether there were any specific areas or skill's that could be supported through BST. Both participants stated issues with skin irritation as a side effect of using CGM, which often negatively impacted their self-management experience and occasionally resulted in needing breaks from using the CGM device to allow the skin time to heal and recover. Once this skill was identified, a task analysis was created based on the instruction manuals for basic application of the CGM to teach the participants the correct way to apply the CGM device.

A 15-step task analysis was used to collect baseline data. Baseline sessions involved asking the participant to complete their usual routine of applying their CGM and marking whether steps from the 15-step task analysis were completed correctly, incorrectly, or missed completely. It should be noted that once the CGM had already been applied after the first baseline session, it remained in place for 10 days, so could not be reapplied for subsequent training sessions. Therefore, a 'mock' setting was used for the remainder of sessions as necessary, where the skill was run through as usual, however, steps such as 10, 12, 14, and 15 were completed as ‘pretend’ actions (but still completed according to the task analysis). That is, if a participant already had a CGM device applied, they were asked to perform the steps as they usually would without physically applying the CGM (e.g. pretending to unscrew the lid and apply the CGM).

Three baseline sessions were conducted per participant, with each baseline session lasting for approximately 5-7 minutes per participant. Following collection of baseline data, BST was implemented. The BST intervention began with the instruction and modelling phases, where participants were provided with the task analysis as a step-by-step instruction guide to read through. This specific aspect was altered to acknowledge Kaupapa Māori practice by adhering to mohiotanga (sharing knowledge/information) and maramatanga (understanding); using patient-friendly language that was not dominated by medical jargon, but explained the basics of the skill needed for the participant to understand the end goal so as to not overwhelm or discourage their participation, but improve their confidence surrounding their participation. The skill of applying a CGM device was then modelled to the participant following the task analysis steps, showing the participant exactly how to follow the instructions and complete each step correctly. This specific aspect was altered to incorporate Kaupapa Māori practice by adhering to whanaungatanga (building relationships) and Kotahitanga (unity); whereby modelling the skill showed participants that it was achievable. Participants were also intentionally met in their safe spaces of choice, which encouraged comfortability and fostered a supportive environment throughout the BST process. There was then time given to implement the third component of BST, which was the rehearsal phase, where participants performed the steps in the task analysis independently and were able to clarify any instructions or steps if needed. This specific aspect was altered to suit Kaupapa Māori practice by adopting a tuakana/teina (peer-learning) like relationship where the participants could rely on the researcher for advice and help if needed and were supported to work through the task analysis. Participant responses were scored the same as for the baseline data, where participants were watched carefully and scoring was based on the number of steps completed correctly from the 15-step task analysis with a mastery criterion of 100%. Finally, the feedback phase involved giving positive reinforcement throughout the rehearsal phase, which involved providing corrective and supportive feedback to participants in order to encourage the completion of the skill in its entirety. This specific aspect was altered to respect Kaupapa Māori practice by adhering to rangatiratanga; showing participants that they were in control of their own health management and could make informed choices with the necessary information provided. Once three sessions were completed, the intervention phase was complete. At the end of the intervention phase, both written and verbal feedback was gathered from the participants. This included an open-ended question posed to participants asking about their experience with BST for their diabetes management and CGM use. At the completion of the research, participants were given koha (gift) which included a laminated step-by-step instruction card (derived from the task analysis) for continued CGM use (appendix E), a handwritten thank you card acknowledging their involvement and expressing gratitude for their participation, and a plant cutting as a token of appreciation (appendix F). These protocols were an integral part of the research methodology and ensured culturally appropriate and ethical research was conducted with Māori participants.

Two-weeks post-intervention, a maintenance phase was conducted to determine retention of the skill learned. Participants were asked again to complete the skill of applying a CGM monitor. After two sessions, the results were assessed, and any improvements were made if necessary. For example, with subject A and B, two post-intervention sessions were completed, however, they were not scoring 15/15 (100%) correct application of steps. Therefore, a step-by-step instruction card was given to the participants for two more sessions, where they were then able to complete the skill to 100%. Scoring during this phase was per the baseline and intervention phases. Post-intervention sessions were completed over four days in the same week, with one session per day. Sessions lasted approximately 8-12 minutes. The mastery criterion was 100%. A total of 11 sessions were completed for both participants over a four-week period, taking approximately 12 minutes per session.

Table 3.

Kaupapa Māori Integration to BST Components.

BST Component	Kaupapa Māori Principle	Integration in Current Study
Pre-intervention relationship building	Whanaungatanga	Initial phone calls, kanohi ki te kanohi meetings before any data collection
Instruction	Mōhiotanga/Maramatanga (knowledge/understanding)	Plain-language instruction cards, avoiding clinical jargon, ensuring comprehension
Modelling	Kotahitanga (unity/collaboration)	Researcher modelling skills alongside participants, showing tasks are achievable
Rehearsal	Tuakana/Teina (peer learning relationship)	Supportive guidance where researcher acts as tuakana (more experienced) to participant's teina (learner)
Feedback	Manaakitanga (care)	Positive reinforcement delivered with respect, preserving participant dignity
Throughout all phases	Tino Rangatiratanga (self-determination)	Participants identify their own learning needs, control pace and setting

Results

Table 4 depicts experimental phases and sessions for both participants and Figure 1 illustrates the percentage of correct steps completed through all phases for both participants. Session numbers are displayed on the x-axis and the percentage of correct steps performed as per the 15-step task analysis are displayed on the y-axis. Both participants demonstrated an increase overall in the percentage of correct steps completed from baseline training. Subject A demonstrated an average of 37.8% (17/45 total steps) during the baseline phase (ranging from 33-40%). Subject A completed steps 4, 6, 7, 9, 10, and 12 consistently through each baseline trial, with step 9 being incomplete once. Steps 1, 2, 3, 5, 8, 11, 13, 14, and 15 were always missed or incomplete (steps shown on Table 1) during baseline. During the BST intervention phase, Subject A improved to an average of 91.7% (55/60 total steps) of the task analysis steps across all sessions (ranging from 73-100%). Two weeks post-intervention, Subject A scored an average of 83.3% (25/30 total steps) over the first two sessions. Following these two post-intervention sessions, a step-by-step card was provided to the participant for two more sessions where they scored 100% (30/30 total steps), with a total average over four sessions of 91.7% (55/60 total steps) overall for the post-intervention phase. This was a demonstrated increase from baseline (37.8%) to intervention and post-intervention phases (91.7%), exhibiting maintenance of the acquired skill.

Subject B demonstrated an average of 51.1% (23/45 total steps) during the baseline phase (ranging from 46-53%). Subject B completed steps 3, 4, 6, 7, 9, 10, 12, and 13 consistently through each baseline session, but steps 1, 2, 5, 8, 11, 14, and 15 were always missed or incomplete. During the BST intervention phase, Subject B improved to an average of 96.7% (58/60 total steps) completion of the task analysis steps across all sessions (ranging from 86-100%). Two weeks post-intervention, Subject B scored an average of 93.3% (28/30 total steps) over the first two sessions. The step-by-step card was then provided to the participant for two more sessions where they scored 100% (30/30 total steps), with a total average over four sessions of 96.7% (58/60 total steps) overall for the post intervention phase and demonstrated an increase from baseline (51.1%) to intervention and post-intervention phases (96.7%), exhibiting maintenance of the acquired skill.

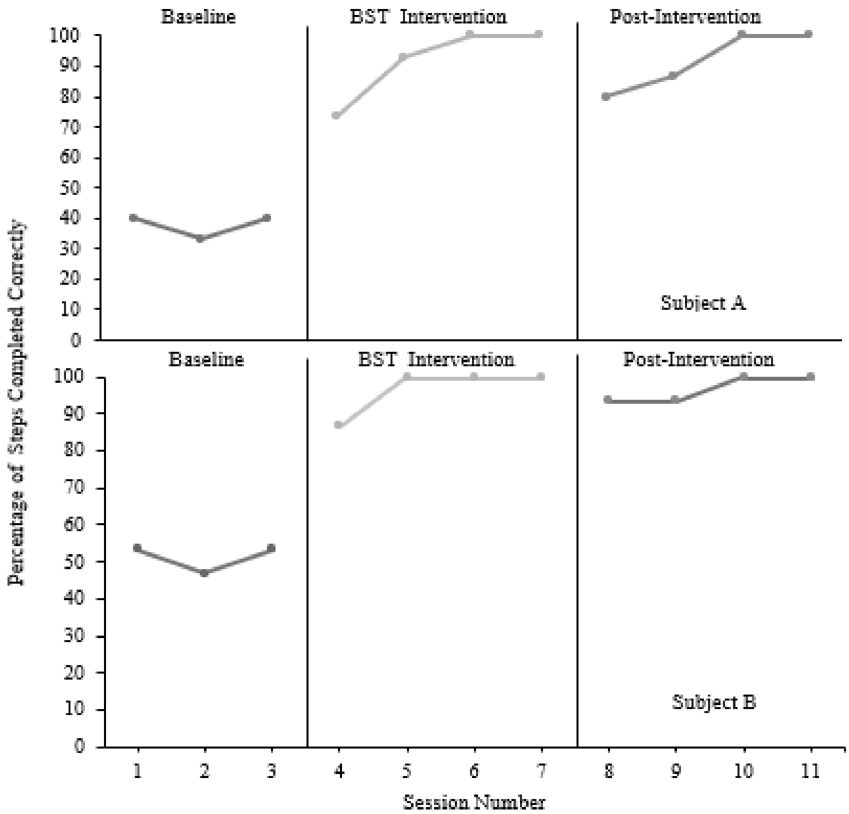
Table 4.

Participant Data Across all Experimental Phases and Sessions.

Experimental Phase	Session	Subject A	Subject B
Baseline	1	40.00%	53.33%
	2	33.33%	46.67%
	3	40.00%	53.33%
Intervention	4	73.33%	86.67%
	5	93.33%	100.00%
	6	100.00%	100.00%
	7	100.00%	100.00%
Post-Intervention	8	80.00%	93.33%
	9	86.67%	93.33%
	10	100.00%	100.00%
	11	100.00%	100.00%

Figure 1.

Percentage of Task Analysis Steps Performed Correctly Following Baseline, BST, and Post-Intervention Phases Across Two Participants (Subjects A and B).



Discussion

This study investigated the use of BST to support independent use of a CGM device for two Māori participants with diabetes. BST was effective in helping participants to apply their CGM, which was a skill that was identified as needing support due to skin irritation that was experienced by both participants when they were applying the CGM device and had resulted in a decrease in the use of their CGM to help manage their diabetes. Both participants showed an increase in the correct number of steps performed in applying their CGM. Participants achieved 100% correct within 2-3 intervention sessions, suggesting that BST is a user-friendly method that can be effective for participants who need to learn new technology to manage their diabetes.

This study supports the use of BST to facilitate health behaviours/skills in a patient group that typically does not receive support in the form of training with new technology devices such as CGM that are designed for long term management (Hilliard et al, 2019; Evans et al, 2024). As previously mentioned, patients are typically not provided with sufficient training on the use of a CGM device (Tanenbaum et al. 2021; Heinemann et al. 2020; Evans et al. 2024). For example, relevant to the current study population, a Pinnacle clinical pharmacist typically provides patients with a 20-minute appointment to discuss CGM as a whole, followed by a 15-minute appointment with a nurse to demonstrate CGM application. These appointments are not funded and are charged to the patient. This is the only training patients receive for CGM as they do not schedule follow-up appointments, which results in many patients left to learn correct application for themselves unless they wish to incur the additional cost of returning for another appointment to access training. A lack of training represents a barrier to CGM use (Wagner et al, 2012) which in the case of the current participants, had led to skin irritation, avoidance and discontinued use of the CGM device.

Skin irritation is another common barrier associated with CGM use and may lead some patients to discontinue wearing the CGM device altogether (Asarani et al, 2020). When CGM use is interrupted, this leads individuals to lose access to the real-time glucose data and feedback that supports daily diabetes self-management decisions (Aleppo et al, 2021). Without access to this data, individuals may lack the necessary information to effectively adjust their diet, exercise/physical activity, or medication schedule, which may result in improper glycaemic control. As mentioned previously, over time, poor diabetes self-management increases the risk of acute health complications. Although the skill of correctly applying a CGM device to prevent future skin irritation may appear minor in comparison to other aspects of diabetes management overall, it plays an important role in supporting continued device usage, CGM engagement, and ultimately improve long-term health outcomes. BST in the current study was effective in facilitating both participants to re-engage with their CGM when they had indicated that skin irritation had become aversive and had led to discontinuation. Both participants showed improved skills in applying their CGM devices, where skin irritation had become a significant barrier to using CGM that had resulted in discontinued CGM use. A discontinuation of CGM means that an individual's diabetes is not being self-managed, which can lead to risk of hyperglycaemia/hypoglycaemia, or more extreme consequences such as hospital admission and stays for monitoring and medication administration (Aleppo et al, 2021). Participants in the current study reported improved skill acquisition when applying the CGM device, so BST was helpful in providing a simple intervention that was tailored to the individual participant and supported skill knowledge to avoid future skin irritation. This is an overall positive health outcome. Positive health outcomes are of particular importance to Māori, who are disproportionately over-represented in the prevalence of diabetes in NZ (Reed, 2025).

Maintaining and learning diabetes self-management behaviours such as dietary requirements, exercise regimes, and glucose monitoring can be challenging for many. Research has frequently identified several barriers that inhibit an individual's ability to understand and apply these behaviours daily. For example, patients consistently report trouble with changing established eating/food habits, lack of understanding surrounding dietary recommendations, and feeling overwhelmed by the amount of lifestyle changes required following a diabetes diagnosis (Nagelkerk et al, 2006). There are also a number of environmental and social factors the affect the success of these behaviours, for example, limited access to healthy food options, limited whānau support, difficulty maintaining regular exercise, or battling time demands (Reed, 2025). These barriers help to understand that successful diabetes self-management is not solely up to the individual, but is influenced by a range of behavioural, environmental, social, and systemic factors. This highlights a need for targeted education, where behavioural interventions like BST may be beneficial in equipping individuals with the knowledge and skills to successfully integrate these self-management behaviours into daily life, improving their overall health outcomes.

BST demonstrates effectiveness in teaching practical skills and promoting behaviour change, with the potential of its application extending beyond diabetes management and into other health-related self-management behaviours. There are many chronic health conditions which require individuals to perform specific behaviours to manage their conditions successfully. For example, adhering to physiotherapy exercises for injury recovery, managing diet and exercise for weight management, monitoring blood pressure and medications for hypertension, and correctly administering inhalers for asthma (Richardson et al 2014). Like diabetes self-management, these behaviours may require individuals to learn new skills and integrate them easily into daily routines for successful health outcomes. BST provides a structured approach to skill acquisition and can be applied seamlessly to these other self-management behaviours and health conditions other than diabetes. The underlying principle of BST has the potential for broader applications within the health field and offers a practical framework simple for healthcare providers as well as patients to adhere to, resulting in improved education, self-efficacy, and long-term engagement in promoting health behaviours across a variety of clinical contexts.

Other health-related research has also reported the effectiveness of BST to train skills. Lin et al (2024) compared the use of BST vs Teaching-as-usual (TAU) for teaching safety skills to mental health service providers and found BST to be significantly more effective than TAU in improving the performance of self-protection and team control skills among healthcare workers. They found that although there was a decrease in skill performance one-month post-training, BST scores remained higher on all three outcome measures (competency, mastery, and confidence) (Lin et al, 2024). Similar outcomes were observed throughout the current research, with skill performance improving, but retention decreased two-weeks post BST intervention phase, suggesting a need for a post-intervention plan to help maintain skill acquisition. This may suggest a necessity for booster/follow-up sessions or permanent prompt provisions put in place (e.g., the step-by-step instruction card) to maintain skill acquisition/performance. Future research should explore optimal schedules for follow-up training as well as resources to support skill maintenance.

Both of the current participants were 58 years old or over and were diagnosed with Type 2 diabetes within the previous three years. While neither reported extensive knowledge of diabetes self-management, both had been using CGM devices for several months or years prior to the study. Despite this history, observations during the baseline phase revealed that both participants had developed application routines that omitted several critical steps from the task analysis (e.g., rotating application sites, allowing disinfected area to dry with no contamination etc). These omissions likely contributed to the skin irritation both participants reported which eventually led to the discontinuation of wearing a CGM device altogether. The purpose of the task analysis was to break down the CGM application process to more simple, observable steps, making the skill more accessible. Often health-related self-management tools such as CGM are complex and information-dense. This can function as a barrier to consistent adherence to self-management behaviours (McSharry, 2020). By breaking down the skill of applying a CGM device correctly into 15 manageable steps, the task analysis helped to reduce the learning required by participants and provided a clear pathway to correct performance. This simplification is of particular importance for older participants learning new health technologies as cognitive age may affect the acquisition of novel procedural skills (Czaja et al, 2019).

A further, significant benefit as a result of this research is that it places individuals/patients at the forefront of their health management, giving them greater control over their autonomy and encourages self-determination (tino rangatiratanga). The successful relationship between BST and CGM provides individuals with the tools and knowledge necessary to understand and process their blood glucose patterns in real time. Rather than having to rely on medical appointments for guidance, individuals are able to actively engage in the day-to-day decision making regarding their diet, exercise, medication, and other treatment. This increases an individual's sense of control, helps individuals to gain confidence in their capability to manage their health condition and can lead to positive effects on their mental and emotional wellbeing (Lambrinou et al, 2019), supporting the notion that BST has the potential to help alleviate barriers in diabetes self-management and training.

Traditionally, BA has not been associated with a Kaupapa Māori approach. Historically, BA emerged from Western scientific ideologies, however, this study demonstrates a successful relationship between the two approaches. This was achieved by utilising the core aspects of BST and adapting the process by integrating observations of tikanga and mātauranga Māori into the core phases of BST. From the early phase of the research, a Kaupapa Māori approach was adopted when whanaungatanga was incorporated from the very first introduction with participants. This research worked towards transformative outcomes; designed by Māori, experienced by Māori, and for the benefit of Māori being at the forefront of the study framework. At the intersection of worldview, a Kaupapa Māori approach and BST align in their shared commitment to support empowerment, collective learning, and skill development, encouraging individuals to actively engage in their health management as well as acknowledging the importance of a culturally grounded framework.

Māori lead in statistics for a number of health conditions compared to non-Māori in Aotearoa NZ, reflecting the burden of health disparities often shaped by historical, social, and systemic/structural factors. Type 2 diabetes is most prevalent among Māori, with an estimate that Māori are two-times more likely to be diagnosed with diabetes than non-Māori (Ministry of Health, 2022). In addition to this, Māori are more at risk of developing diabetes at a younger age, as well as experiencing more severe health complications such as limb amputation, cardiovascular disease, or kidney failure (Ministry of Health, 2024). As a result of these disparities, Māori are faced with a number of barriers to effective diabetes self-management, including access to culturally appropriate health services and treatment, and education surrounding their health condition. To be able to address these inequities appropriately, they require a culturally responsive/tailored approach to healthcare interventions that are grounded in tikanga Māori worldview, offering self-management strategies that help to empower individuals, their whānau, and wider community to effectively reduce long-term complications.

As such, this research has shown considerable potential to provide meaningful, positive benefits for Māori by utilising a Kaupapa Māori approach with a Western evidence-based practice such as BST, providing a culturally informed intervention for diabetes self-management. As mentioned previously, with the disproportionate burden Māori experience with diabetes, an intervention which acknowledges tikanga Māori is critical for improving long-term health outcomes and reducing long-term complications (Walker et al, 2006). The consistent skill acquisition which was demonstrated by both participants (reaching 100% mastery within 2-3 intervention sessions) implies that cultural safety was created through a Kaupapa Māori approach. When individuals feel valued, respected, and have autonomy over their position within health research (tino rangatiratanga), they may be more engaged, receptive, and provide better outcomes for Māori (Jansen et al, 2022). The implications of BST alongside CGM provides a practical self-management strategy that focuses on building knowledge, accessibility, confidence, self-determination, and is a sustainable practice which can be easily altered to consider cultural appropriateness, leading to Māori individuals and the wider community having greater health autonomy and support improved Hauora, contributing to more equitable health outcomes in Aotearoa NZ. This claim is supported by Subject B's verbal comment during post-intervention feedback "*I really appreciated how tikanga Māori was used throughout, it made me feel comfortable continuing my participation and made me feel like we were on the same level rather than used as a guinea pig*". This reflects the successful establishment of a tuakana/teina relationship, rather than a traditional hierarchical researcher-participant dynamic.

The wider application of this research is the potential for BST alongside CGM with respect to a Kaupapa Māori approach to be implemented into diabetes education programmes delivered to patients, whether this be through Māori health providers, or community-based initiatives. This model could support other learning for Māori who experience barriers to their diabetes self-management and could be applied and adapted to other skill-building settings such as information processing overload, alert fatigue, and other areas individuals may find particularly challenging.

Limitations

The current study may be limited by a small sample size, although two participants are suitable to conduct single-research design typical in behaviour analysis. The main focus of this study was to benefit Māori to improve skill acquisition and ultimately, long-term diabetes self-management. A limitation was that through Pinnacle, few Māori were identified as users of CGM, so recruitment was challenging. Further recruitment of additional Māori CGM users would provide increased evidence of the effectiveness of BST as a training tool for CGM skill acquisition. The lack of Māori engaging with CGM suggests further research is needed to identify factors contributing to any potential inequity.

Conclusion

This research has demonstrated that BST, when weaved thoughtfully with Kaupapa Māori principles, successfully and effectively supports Māori participants to improve their diabetes self-management through correct CGM application. This research contributes to growing evidence that a culturally responsive/tailored intervention is not just for show but is essential for achieving equitable health outcomes for Māori. In future, BST and a Kaupapa Māori approach may be woven together to investigate its effectiveness in other health-related areas which require an individual's self-management. Further research would also consider investigating follow-up/maintenance schedules for to improve long-term acquisition of specific skills.

References

Aleppo, G., Beck, R. W., Bailey, R., Ruedy, K. J., Calhoun, P., Peters, A. L., & Bergenstal, R. M. (2021). The effect of discontinuing continuous glucose monitoring in adults with type 2 diabetes treated with basal insulin. *Diabetes Care*, *44*(12), 2729-2737.

Asarani, N. A. M., Reynolds, A. N., Boucher, S. E., de Bock, M., & Wheeler, B. J. (2020). Cutaneous complications with continuous or flash glucose monitoring use: systematic review of trials and observational studies. *Journal of diabetes science and technology*, *14*(2), 328-337.

Azrin, N. H., & Foxx, R. M. (1971). A rapid method of toilet training the institutionalized retarded. *Journal of Applied behaviour Analysis, 4*(2), 89-99. https://doi.org/10.1901/jaba.1971.4-89

Beaton, A., Manuel, C., Tapsell, J., Foote, J., Oetzel, J. G., & Hudson, M. (2019). He Pikinga Waiora: supporting Māori health organisations to respond to pre-diabetes. *International journal for equity in health*, *18*(1), 3. https://doi.org/10.1186/s12939-018-0904-z

Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors predicting the use of technology: findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and aging*, *21*(2), 333.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2020). Applied behavior analysis (3rd ed.). Pearson.

Crosswell, R. J., Nikora, H., Paul, R. G., Buntting, C. M., Roa, T., Keenan, R., Aporosa, S. "Apo," Paekau, C., Raumati, G., Moorhouse, S., & Latu, A. T. F. (2025). Ascending the Poutama: Culturally responsive diabetes care for Māori communities. CSIRO Publishing.

DeCarli, J. M., Aclan, M. D., Lindgren, N. A., & Diaz, C. (2025). In-person and telehealth behavioral skills training to reduce child restraint system misuse. *Journal of Organizational Behavior Management*, *45*(1), 48-79.

Diabetes New Zealand. (2025). https://www.diabetes.org.nz/

Egan, A. M., & Dinneen, S. F. (2022). What is diabetes? *Medicine (Abingdon. 1995, UK Ed.)*, *50*(10), 615–618. https://doi.org/10.1016/j.mpmed.2022.07.001

Evans, E. I., Pincus, K. J., Seung, H., & Rochester-Eyeguokan, C. D. (2024). Health literacy of patients using continuous glucose monitoring. *Journal of the American Pharmacists Association*. https://doi.org/10.1016/j.japh.2024.102109

Fienup, D. M., Mudgal, D., & Pace, G. (2013). Increasing money-counting skills with a student with brain injury: Skill and performance deficits. *Brain Injury*, *27*(3), 366-376.

FreeStyle Libre. (2025). https://www.freestyle.abbott/us-en/home.html

Goodwin, D., & Boulton, A. (2024). Co-designing health research in Aotearoa New Zealand, Lessons from the Healthier Lives National Science Challenge. Healthier Lives–He Oranga Hauora National Science Challenge. https://www.healthierlives.co.nz/publications/co-designing-health-research-Aotearoa

Harvey, J. N., & Lawson, V. L. (2009). The importance of health belief models in determining self-care behaviour in diabetes. *Diabetic Medicine*, *26*(1), 5-13.

Heinemann, L., & Klonoff, D. C. (2020). An opportunity to increase the benefit of CGM usage: the need to train the patients adequately. *Journal of Diabetes Science and Technology*, *14*(6), 983-986.

Hilliard, M. E., Levy, W., Anderson, B. J., Whitehouse, A. L., Commissariat, P. V., Harrington, K. R., & DiMeglio, L. A. (2019). Benefits and barriers of continuous glucose monitoring in young children with type 1 diabetes. *Diabetes technology & therapeutics*, *21*(9), 493-498.

Janapala, R. N., Jayaraj, J. S., Fathima, N., Kashif, T., Usman, N., Dasari, A., &

Sachmechi, I. (2019). Continuous glucose monitoring versus self-monitoring of blood glucose in type 2 diabetes mellitus: a systematic review with meta-analysis. *Cureus*, *11*(9).

Jansen, P., Bacal, K., & Buetow, S. (2022). Cultural safety in Aotearoa New Zealand: From policy to practice. *Journal of the Royal Society of New Zealand, 52*(3), 245-260.

Jimenez-Gomez, C., & Beaulieu, L. (2022). Cultural responsiveness in applied behavior analysis: Research and practice. *Journal of Applied Behavior Analysis, 55*(3), 650-673. https://doi.org/10.1002/jaba.992

Kidd, J., Cassim, S., Rolleston, A., Keenan, R., Lawrenson, R., Sheridan, N., Warbrick, I., Ngaheu, J., & Hokowhitu, B. (2021). Hā Ora: Reflecting on a Kaupapa Māori community-engaged co-design approach to lung cancer research. https://doi.org/10.32799/ijih.v16i2.33106

Kim, S., Park, S., Jin, S. M., Kim, J. H., & Kim, G. (2026). Association of perceived diabetes stigma with time below range< 3.0 mmol/L and anxiety in adults with type 1 diabetes using continuous glucose monitoring. *Diabetic Medicine*.

Lambrinou, E., Hansen, T. B., & Beulens, J. W. (2019). Lifestyle factors, self-management and patient empowerment in diabetes care. *European journal of preventive cardiology*, *26*(2_suppl), 55-63.

Lin, E., Malhas, M., Bratsalis, E., Thomson, K., Hargreaves, F., Donner, K., ... & Busch, L. (2024). Behavioral skills training for teaching safety skills to mental health service providers compared to training-as-usual: a pragmatic randomized control trial. *BMC health services research*, *24*(1), 639.

McSharry, J., Byrne, M., Casey, B., Dinneen, S. F., Fredrix, M., Hynes, L., ... & Morrissey, E. (2020). Behaviour change in diabetes: behavioural science advancements to support the use of theory. *Diabetic Medicine*, *37*(3), 455-463.

Mertig, R. G. (2012). *Nurses' guide to teaching diabetes self-management* (2nd ed.). Springer Pub.

Ministry of Health. (2022). *Virtual diabetes register annual data explorer 2022.* https://minhealthnz.shinyapps.io/virtual-diabetes-register-annual-data-explorer/

Ministry of Health. (2024). *Tatau Kahukura: Māori health chart book 2024.* Wellington, New Zealand: Ministry of Health. https://www.health.govt.nz/system/files/2024-12/tatau-kahukura-maori-health-chart-book-2024-v4.pdf

Nagelkerk, J., Reick, K., & Meengs, L. (2006). Perceived barriers and effective strategies to diabetes self-management. *Journal of advanced nursing*, *54*(2), 151-158.

Patel, M. R., Piazza, C. C., Martines, C. J., Volkert, V. M., & Santana, C. M. (2002). An Evaluation of two differential reinforcement procedures with escape extinction to treat food refusal. *Journal of Applied Behaviour Analysis, 35*(4), 363-374. https://doi.org/10.1901/jaba.2002.35-363

Pharmac. (2025). *Continuous glucose monitors (CGMs).* https://www.pharmac.govt.nz/

Quintero, L. M., Moore, J. W., Yeager, M. G., Rowsey, K., Olmi, D. J., Britton-Slater, J., Harper, M. L., & Zezenski, L. E. (2020). Reducing risk of head injury in youth soccer: An extension of behavioral skills training for heading. *Journal of Applied Behavior Analysis, 53*(1), 237-248. https://doi.org/10.1002/jaba.677

Rasmussen, E. B., Clay, C. J., Pierce, W. D., & Cheney, C. D. (2022). Behavior analysis and learning: A biobehavioral approach. Routledge.

Reed, K., (2025 December). Diabetes and Inequities Among Māori and Pacific Peoples in Aotearoa. *Diabetes Info NZ*. https://www.diabetesinfo.org.nz/diabetes-and-inequities-among-maori-and-pacific-peoples-in-aotearoa/

Richardson, J., Loyola-Sanchez, A., Sinclair, S., Harris, J., Letts, L., MacIntyre, N. J., ... & Martin Ginis, K. (2014). Self-management interventions for chronic disease: a systematic scoping review. *Clinical rehabilitation*, *28*(11), 1067-1077.

Roglic, G. (2016). WHO Global report on diabetes: A summary. *International Journal of Noncommunicable Diseases*, *1*(1), 3-8.

Rolleston, A., (2022). Navigating the space between codesign and mahitahi in Māori health research. Kotuitui: *New Zealand Journal of Social Sciences Online, 17*(2), 270–285. https://doi.org/10.1080/1177083X.2022.2089406

Skinner, B. F. (1965). Science and human behavior. Simon and Schuster.

Tane, T., Selak, V., Hawkins, K., Lata, V., Murray, J., Nicholls, D., ... & Harwood, M. (2021). Māori and Pacific peoples' experiences of a Māori-led diabetes programme. *NZ Med J*, *134*(1543), 79-89.

Tanenbaum, M. L., Messer, L. H., Wu, C. A., Basina, M., Buckingham, B. A., Hessler, D., & Hood, K. K. (2021). Help when you need it: perspectives of adults with T1D on the support and training they would have wanted when starting CGM. *Diabetes research and clinical practice*, *180*, 109048.

Smith, L. T. (2021). *Decolonizing methodologies: Research and Indigenous peoples* (3rd ed.). Bloomsbury.

Te Whatu Ora (2025, April 14). *About Diabetes.* https://www.tewhatuora.govt.nz/for-health-professionals/clinical-guidance/diseases-and-conditions/long-term-conditions/diabetes/about-diabetes

Vanselow, N. R., & Hanley, G. P. (2014). An evaluation of computerized behavioral skills training to teach safety skills to young children. *Journal of Applied Behavior Analysis, 47*(1), 51-69. https://doi.org/10.1002/jaba.96

Wagner, J., Tennen, H., & Wolpert, H. (2012). Continuous glucose monitoring: a review for behavioral researchers. *Biopsychosocial Science and Medicine*, *74*(4), 356-365.

Walker, S., Eketone, A., & Gibbs, A. (2006). An exploration of kaupapa Māori research, its principles, processes and applications. *International Journal of Social Research Methodology, 9*(4), 331-344.

Williams, W. L., & Jackson, M. (2012) Enuresis. *Handbook of Evidence-Based Practice in Clinical Psychology*. John Wiley & Sons, Inc. https://doi.org/10.1002/9781118156391.ebcp001016

APPENDICES

Appendix A.

Study Information Sheet.

UNIVERSITY OF WAIKATO HREC COMMITTEE APPLICATION FORM

Appendix A: Study Information Sheet

Pinnacle Primary Health Care Ltd

THE UNIVERSITY OF WAIKATO Te Whare Wānanga o Waikato

STUDY INFORMATION SHEET

Study title: Improving Diabetes Self-Management in Māori Communities: The Use of Behavioral Skills Training (BST) with Continuous Glucose Monitoring (CGM).

Locality: Waikato Region

Ethics committee ref: HREC(Health)2025#26

Lead investigator: Nikcarla Laird (UoW Student ID #1535213)

Contact phone number: (+64)27 448 1079

WHAT IS THE PURPOSE OF THE STUDY?

The University of Waikato invites you to take part in a student's Masters research project looking at the behavioural and supportive care needs of patients managing Diabetes using Continuous Glucose Monitoring (CGM) systems. With the University of Waikato, we are looking to work with male and female, Māori patients of all ages who have been diagnosed with diabetes who use CGM devices. We would like to understand the following:

- Whether Behavioural Skills Training has a positive impact on diabetes management and CGM use (e.g., reducing number of alerts per day).
- The training needs for Māori patients who use CGM.
- Which behavioural needs are currently being met and/or not being met.
- Whether patients find BST to be a positive experience for their CGM use and overall diabetes management.
- Any other factors related to diabetes management and CGM that are useful to know.

This study is being carried out in conjunction with the support of Primary Healthcare Limited (PHCL), also referred to as Pinnacle who's role is solely used for the recruitment process. This research project has been approved by the ~~ALPSS~~ Human Research Ethics Committee at the University of Waikato as HREC(Health)2025#26. Any questions or concerns regarding ethical conduct of this research may be sent to the secretary of this committee at humanethics@waikato.ac.nz, postal address: Human research Ethics Committee (Health), University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

WHAT WILL MY PARTICIPATION IN THIS STUDY INVOLVE?

Your participation will involve first creating a baseline by tracking your daily CGM alerts. Next, a researcher will instruct you on how to deal with information fatigue mindfully using a systematic approach, clear instruction, and modelling the desired behaviour (navigating information fatigue mindfully). This will be done in a location of your choosing, whether this be in the comfort of your own home, or another location you feel comfortable. BST consists of four components; instruction, modelling, rehearsal, and feedback. The first three sessions will range from 30 minutes to an hour and from then on will only require you to keep a digital/physical record of the number of CGM alerts within a day. Finally, a feedback form will be completed. This will be used to track whether BST had any effect on daily CGM alerts. A whānau member/support person is welcome to attend these sessions if it will make you feel more comfortable. You can end these sessions at any time.

Sessions may be recorded using a dictaphone. The researcher will inform you if the session will be recorded.

If you wish to take part and do not have any questions, please sign the attached consent form and email it to nl118@students.ac.waikato.nz. If a consent form was mailed to you, you will be able to return it via a postage paid envelope. If you want to take part, but would like some questions answered, please contact the researcher on (+64)27 448 1079.

How will my information be kept private?

All information will be confidential. Once you have consented to take part, you will be assigned a study ID. All data will be analysed under this study ID to assure your privacy and anonymity. No patient identifiers (names) will appear in any analysis, presentations or reports about this study. All aspects of the study will be strictly confidential and only the researchers (Nikcarla & Dr Blackmore) involved will have access to your information. You have the right to see and amend your session data. On completion of the study, we can provide you with a report of the findings. If you would like to receive this report, please tick the box on the consent form.

What are the possible benefits and risks of this study?

There will be no risks to you in participating in this study. We hope that this study will result in better understanding the patient perspective of managing a chronic condition such as diabetes to benefit future patients.

Who pays for the study?

This study is non-funded, however, it will not cost you anything.

What are my rights?

Your participation is voluntary (your choice). If you do not want to take part, please indicate 'no' or disregard this information. You are free to withdraw from the study at any time without giving a reason. This will not affect your continuing health care. If withdrawing, your CGM data will be deleted up to 14 days after completing the session.

Who do I contact for more information or if I have concerns?

If you have any questions, concerns or complaints about the study, you can contact:

Nikcarla Laird, Student & Researcher, University of Waikato
+64 27 448 1079
nl118@students.waikato.ac.nz
Dr Tania Blackmore, Supervisor, University of Waikato
tania.blackmore@waikato.ac.nz

If you have any questions about your rights as a participant, you can contact an independent health and disability advocate. This is a free service provided under the Health and Disability Commissioner Act.

Phone: **0800 555 050**
Fax: **0800 2 SUPPORT (0800 2787 7678)**
Email: **advocacy@hdc.org.nz**

For Māori health support please contact:
Te Puna Oranga Māori Health Service 07 839-8899
Te Puna Oranga Māori Health is a service for Maori and pasifika research consultation to ensure the research is culturally safe. Participants can contact these support services if they have any questions or concerns on the cultural integrity of the research they will be participating in.

Thank you for taking the time to read this Study Information Sheet and your consideration of participating in this study to help patients managing Diabetes in New Zealand.

Appendix B.

Consent for Contact by the University/Researcher.

UNIVERSITY OF WAIKATO HREC COMMITTEE APPLICATION FORM

Appendix B: Consent for Contact by the University.

CONSENT FOR CONTACT BY A UNIVERSITY RESEARCHER

Participant's name: ____________________

Signature: ____________________ Date: ____________________

Phone number: ( ) ____________________

Best day and time to be contacted: ____________________

Appendix C.

Participant Consent Form.

Appendix C: Participant Consent Form.

Pinnacle Primary Health Care Ltd   THE UNIVERSITY OF WAIKATO *Te Whare Wānanga o Waikato*

Patient Consent Form

Study title: Improving Diabetes Self-Management in Māori Communities: The Use of Behavioral Skills Training (BST) with Continuous Glucose Monitoring (CGM).

Principal investigator: Nikcarla Laird (Student ID #1535213)

I have read, or have had read to me, and I understand the Study Information Sheet.	Yes ☐	No ☐
I have been given sufficient time to consider whether or not to participate in this study.	Yes ☐	No ☐
I have had the opportunity to use a legal representative, whanau/ family support or a friend to help me ask questions and understand the study.	Yes ☐	No ☐
I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet.	Yes ☐	No ☐
I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without this affecting my medical care.	Yes ☐	No ☐
I consent to the research staff collecting and processing my information, including information about my health (e.g., accessing hospital records which will be limited to age, ethnicity, length of diagnosis, treatments received).	Yes ☐	No ☐
I have the right to withdraw from the study and to withdraw my information. I agree that the information collected about me up to the point when I withdraw may continue to be processed. If withdrawing, your session data will be deleted up to 7 days after completing the session.	Yes ☐	No ☐
I agree to an approved auditor appointed by the New Zealand Health and Disability Ethic Committees, or any relevant regulatory authority or their approved representative reviewing my relevant medical records for the sole purpose of checking the accuracy of the information recorded for the study.	Yes ☐	No ☐

I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.	Yes ☐	No ☐
I know who to contact if I have any questions about the study in general.	Yes ☐	No ☐
I consent to my participation being recorded and understand my responsibilities as a study participant.	Yes ☐	No ☐
I wish to receive a summary of the results from the study.	Yes ☐	No ☐

Participant name: ______________________________

Signature: ____________________ Date: ____________________

Phone number: ( ) ______________________________

Best day and time to be contacted: ______________________________

Declaration by member of research team:

I have given either a written or a verbal explanation of the research project to the participant and have answered the participant's questions about it.

I believe that the participant understands the study and has given informed consent to participate.

Researcher's name: ______________________________

Signature: ____________________ Date: ____________________

PLEASE RETURN THIS CONSENT FORM

Appendix D.

Participant Feedback Form.

UNIVERSITY OF WAIKATO HREC COMMITTEE APPLICATION FORM

Appendix E: BST Final Feedback Form

BST Feedback Form

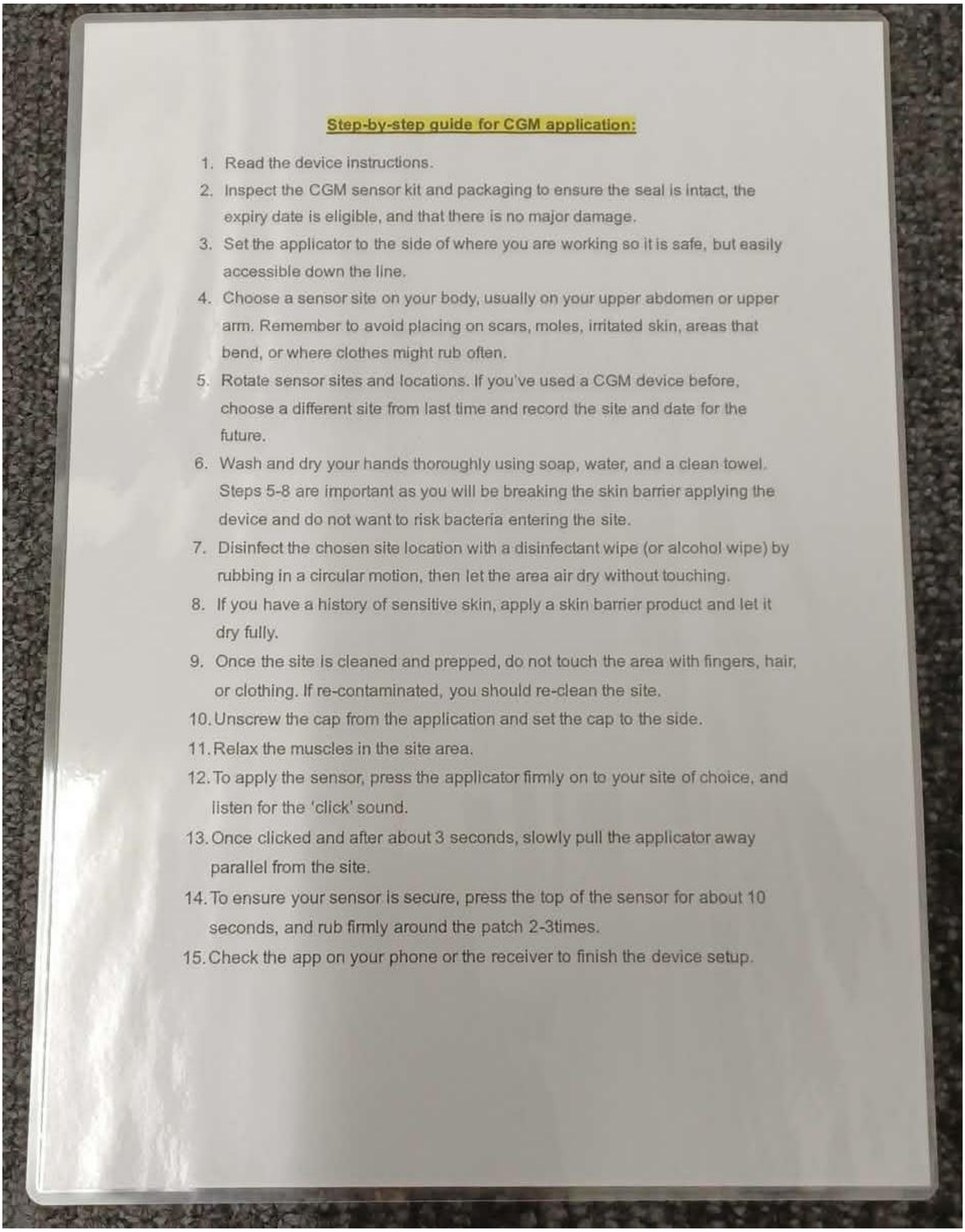
Please provide overall feedback from your experience with Behavioural skills training for your diabetes management and CGM use. (e.g., positive/negative?, improved management?, more/less alerts?, easy to implement? etc).

Please provide feedback below:

Thank you for your participation in this study.

Appendix E.

Step-by-step Instruction Card. Given as Koha to Patients Following Completion of Maintenance.



Step-by-step guide for CGM application:

1. Read the device instructions.
2. Inspect the CGM sensor kit and packaging to ensure the seal is intact, the expiry date is eligible, and that there is no major damage.
3. Set the applicator to the side of where you are working so it is safe, but easily accessible down the line.
4. Choose a sensor site on your body, usually on your upper abdomen or upper arm. Remember to avoid placing on scars, moles, irritated skin, areas that bend, or where clothes might rub often.
5. Rotate sensor sites and locations. If you've used a CGM device before, choose a different site from last time and record the site and date for the future.
6. Wash and dry your hands thoroughly using soap, water, and a clean towel. Steps 5-8 are important as you will be breaking the skin barrier applying the device and do not want to risk bacteria entering the site.
7. Disinfect the chosen site location with a disinfectant wipe (or alcohol wipe) by rubbing in a circular motion, then let the area air dry without touching.
8. If you have a history of sensitive skin, apply a skin barrier product and let it dry fully.
9. Once the site is cleaned and prepped, do not touch the area with fingers, hair, or clothing. If re-contaminated, you should re-clean the site.
10. Unscrew the cap from the application and set the cap to the side.
11. Relax the muscles in the site area.
12. To apply the sensor, press the applicator firmly on to your site of choice, and listen for the 'click' sound.
13. Once clicked and after about 3 seconds, slowly pull the applicator away parallel from the site.
14. To ensure your sensor is secure, press the top of the sensor for about 10 seconds, and rub firmly around the patch 2-3times.
15. Check the app on your phone or the receiver to finish the device setup.

Appendix F.

Koha Given to Participants at the end of the Post-Intervention Phase.