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# **Point of care capillary blood glucose monitoring**

Educational material for nursing students

DEGREE PROGRAMME IN NURSING  
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## ABSTRACT

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Point-of-care (POC) testing is a rapid medical diagnostic test conducted at the patient's bedside instead of in a laboratory. Point-of-care glucometers are still commonly used to analyse blood glucose levels in healthcare settings. Monitoring blood glucose is a crucial aspect of diabetes management, and using a glucometer enables timely adjustments to treatment plans. This thesis is essential for nursing students as it emphasizes the importance of accurately monitoring blood glucose levels using a glucometer.

The purpose of this project thesis was to produce educational material using a PowerPoint presentation focusing on capillary blood glucose measurement as a point-of-care test guide for nursing students at SAMK. The objective of this thesis was to enhance nursing student's skills in monitoring the blood glucose of a patient. The cooperation partner for this project is SAMK. The educational material product was developed using a relevant theoretical framework supported by credible evidence-based sources.

The authors included in the PowerPoint presentation helpful visuals, such as pictures that accurately demonstrate how to measure blood glucose levels using a glucometer. The PowerPoint presentation is high quality, encompassing all essential details and images.

The Waterfall method was employed as the project management approach for this thesis. This linear and sequential method proved advantageous in project management. The thesis and its accompanying product fulfilled the requirements of the studies at SAMK. The supervisors and lecturers involved in the thesis thoroughly evaluated the product and expressed satisfaction.

Keywords: point-of-care testing, capillary blood glucose analysis, diabetes, educational material.

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# 1 INTRODUCTION

This Point-of-care testing (POCT) has seen significant developments in recent years, with the introduction of new technologies and improvements to existing ones. For example, the use of biosensors in POCT has shown promise for more accurate and efficient testing (Alasadi et al., 2020).

POC diagnostics are tests performed near the patient by nursing unit staff that significantly impact treatment decisions. While POC diagnostics had a smaller role in the past, this situation has changed drastically. For instance, testing blood glucose levels using POC testing can deliver rapid and efficient results at the patient's bedside or in a healthcare provider's office, allowing healthcare practitioners to make real-time adjustments to treatment plans based on precise readings. This leads to greater patient comfort and independence and decreases the risk of complications resulting from poorly managed blood glucose levels. (Lehto et al., 2014).

As future healthcare professionals, nursing students must have a comprehensive understanding of diabetes management, including the importance of blood glucose monitoring. Point-of-care testing has become essential for improving the healthcare outcomes of patients with diabetes. One way to achieve better-quality point-of-care glucose testing in hospitals and primary healthcare is through practical training guidance (Lehto et al., 2014).

Diabetes represents a significant health concern both in Finland and on a global scale. According to FinDM database in the general population, the age-standardised prevalence rate of T1D (Type 1-diabetes) climbed consistently from 68 to 96 per 10,000 people between 2000 and 2017. For T2D (Type-2 diabetes), it climbed from 391 to 725 per 10,000 person-years during the same period. (Arffman, et al., 2020)

The purpose of this project thesis is to produce educational material using a PowerPoint presentation focusing on capillary blood glucose measurement as

a point-of-care test guide for nursing students at SAMK. The objective of this thesis is to enhance nursing student's skills in monitoring the patient's blood glucose. The cooperation partner for this project is SAMK.

## 2 THEORETICAL BACKGROUND

To understand the principles and techniques of capillary blood glucose analysis to provide high-quality care to patients with diabetes, component the essential is to comprehend the key concepts involved in point-of-care blood glucose testing. This project thesis significantly focuses on key concepts such as diabetes, point-of-care testing, capillary blood glucose analysis, stages of capillary blood glucose and PowerPoint as educational material.

### 2.1 Diabetes

Diabetes is a chronic metabolic disorder characterized by elevated blood glucose levels resulting from insufficient insulin production, impaired insulin action, or both. It is a complex condition that requires ongoing medical management and lifestyle modifications to prevent complications. (Diabetes in Finland, 2023.)

Diabetes involves the continuous monitoring of blood sugar or blood glucose concentration and blood obtained through skin puncture is a blend of unspecified quantities of blood sourced from arterioles, venules, capillaries, as well as interstitial and intracellular fluids. Blood sugar signifies the measurement of concentrated glucose within the bloodstream. The average reference values for fasting blood sugar derive from plasma, ranging between 4-7 mmol/L, while post-meal readings two hours later should remain under 8-10 mmol/L. A measurement below 3 mmol/L denotes hypoglycaemia, whereas a value surpassing 10 mmol/L signifies hyperglycaemia. Blood sugar targets remain distinctly individual. Additionally, the doctor implements specific treatment plans for

changes in blood sugar levels based on the patient's case (Rautava-Nurmi et al., 2020 p266.)

Adhering to accurate procedures for monitoring capillary blood glucose provides reliable results. Nonetheless, healthcare professionals must recognize and understand risk factors and symptoms linked to unstable blood glucose levels, encompassing both hyperglycemia and hypoglycemia (Rautava-Nurmi et al., 2020.)

Hypoglycemia symptoms include tremors, nervousness, palpitations, sweating, weakness, fatigue, difficulty concentrating, abdominal pain, dizziness, and blurred vision. The recommended treatment involves the consumption of fast-absorbing carbohydrates, with severe cases potentially leading to convulsions. Hypoglycemia can also lead to insulin shock, resulting in unconsciousness (Rautava-Nurmi et al., 2020). Conversely, if a healthy person's blood sugar concentration drops below 3.5 mmol/l, hospital care is necessary (Diabetes-lehti Finland, 2023.)

Hyperglycemia denotes elevated blood sugar levels, featuring symptoms such as fatigue, increased thirst, and frequent urination. Diabetic ketoacidosis is a state of unconsciousness resulting from hyperglycemia, marked by excessively high blood glucose levels. Invariably, hospital treatment is essential, including intravenous fluid, electrolyte replacement, or insulin therapy (Rautava-Nurmi et al., 2020, p. 267.)

There are different types of diabetes. One such type is type 1 diabetes mellitus (T1D), an autoimmune disease that destroys the insulin-producing cells in the pancreas. T1D presents with various metabolic, genetic, and immunogenetic characteristics, affecting people of different ages in varying ways. As a result, a personalized treatment approach is necessary. The loss of insulin secretion can occur either rapidly or slowly. Residual insulin production, which higher c-peptide levels can detect, is more common in adults with T1D, while diabetic ketoacidosis is more prevalent in youths with T1D (Ehrmann D et al., 2020). With a population of 5.5 million, Finland has around 50,000 individuals living

with type 1 diabetes, in children is more common in Finland. The elderly can also develop type 1 diabetes, and insulin treatment is necessary throughout life, administered through injection or pump. (Diabetes Finland, 2023.)

Type 2 Diabetes Mellitus is one of the most common metabolic disorders worldwide. It occurs primarily because of two main factors: the insufficient insulin release by pancreatic  $\beta$ -cells and the inability of insulin-sensitive tissues to respond to insulin (Roden et al., 2019). Four hundred thousand (400,000) people with type 2 diabetes in Finland. The number of undiagnosed cases of type 2 diabetes is estimated at 50 000. (Diabetes Finland, 2023.)

Gestational Diabetes is a type of diabetes that occurs during pregnancy, usually between the 24th and 28th week. Higher-than-normal blood sugar levels characterize the condition due to the body's inability to produce enough insulin to meet the demands of pregnancy. It is essential to manage this condition carefully to ensure the best outcomes for both the mother and the developing fetus, as it poses risks. (Keikkala et al., 2020.)

The diagnostic criteria, as outlined in the Finnish Gestational Diabetes (Fin-GeDi) Study, often involve a fasting glucose level, one-hour post-glucose load level, and two-hour post-glucose load level. If these levels exceed the established thresholds, gestational diabetes is diagnosed. Timely diagnosis and appropriate management, which may include dietary changes, physical activity, and in some cases, insulin therapy, are essential to mitigate potential complications for both the mother and the unborn child. (Keikkala et al., 2020.)

The major objective of treatment is glycaemic control to prevent damage to the target organ and its repercussions. Poor glycaemic control is a major factor to the onset of conditions like diabetes, which raise healthcare expenses, shorten life expectancy, and worsen quality of life. This is a serious public health concern. Long-term hyperglycaemia that is not under control can result in a variety of macro- and micro-vascular issues, such as nephropathy, retinopathy, cardiovascular diseases, amputations, and even early mortality. Numerous studies

have found that the glycaemic management of more than half of diabetics is insufficient (Kurkela et al.,2021). To achieve optimal glucose control, patients must take their prescribed medications as prescribed, change their lifestyles, and periodically check their blood glucose levels (Ufuoma, et al., 2016.)

## 2.2 Point of care testing (POCT)

Point-of-care testing (POCT) is a term used to describe diagnostic testing that is carried out at the patient's bedside or a healthcare provider's office. This type of testing is quick and convenient, and results are available immediately. To improve patient outcomes, POCT enables medical professionals to modify treatment strategies in real-time in response to precise and timely test results. (Celi et al., 2020.)

Hospitals require efficient near-patient glucose monitoring techniques that are rapid, accurate, and cost-effective to effectively manage blood glucose (BG) levels within narrow therapeutic ranges. While plasma glucose central laboratory testing (CLT) remains the gold standard, point-of-care testing (POCT) BG has emerged as a highly suitable alternative due to its accessibility and swift turnaround time. POCT allows for glucose monitoring at the patient's bedside, enabling timely adjustments to treatment plans based on real-time BG results. Its remote location and rapid processing time make POCT an invaluable tool in delivering timely and precise diabetes management within hospital settings. (Choi et al., 2021.)

## 2.3 Capillary blood glucose analysis

A typical POCT for managing diabetes is capillary blood glucose analysis, which enables quick and precise assessment of blood glucose levels using a little amount of capillary blood acquired through a finger prick. Based on precise and timely blood glucose measurements, capillary blood glucose analysis enables healthcare professionals to modify insulin dosages and other treatment strategies in real-time. (Haupt et al., 2021.)

In patients who do not regularly perform self-monitoring of blood glucose (SMBG) and have not recently undergone an HbA1c test, point-of-care (POC) capillary blood glucose readings can offer crucial clinical insights into their current diabetes management. Elevated POC capillary blood glucose levels in such patients may indicate potential challenges in adhering to dietary plans or medication regimens, warranting more intensive counselling on nutritional habits or medication compliance. Furthermore, extremely high POC capillary blood glucose levels could signal the need for more frequent adjustments in anti-diabetic medications rather than waiting for the HbA1c test, typically conducted every three months. POC capillary blood glucose readings in these scenarios can aid in timely interventions to optimize diabetes control and improve patient outcomes. (Sn et al., 2016.)

#### 2.4 Stages of capillary blood glucose

Point-of-care measurement of blood glucose involves a simple and efficient process. To begin, a small drop of capillary blood is obtained by pricking the skin with a single-use, auto-disabling lancet. This process is minimally invasive and relatively painless for the patient. Next, the drop of blood is carefully applied to a specially prepared chemical reagent strip. The reagent strip contains specific chemicals that react with glucose in the blood, resulting in a colour change. The reflectance meter, a handheld device, is then used to measure the intensity of the colour change on the reagent strip. By analysing the intensity of the colour, the meter provides an accurate measurement of the blood glucose level within seconds. This method is widely used in healthcare settings, as it offers a quick, convenient, and reliable way to monitor blood glucose levels for individuals with diabetes or other medical conditions requiring frequent glucose monitoring (Verensokerin Omaseuranta, 2019.)

Preparation: Preparation involves several essential steps to ensure a smooth and accurate capillary blood glucose before measuring blood sugar, the nurse prepares the necessary equipment, which includes an alcohol swab, a blood

glucose meter, test strips, a single-use "safe sharp" lancet device, a sharps container, clean gauze for wiping the first blood drop, disposable gloves, documentation/diary, and detergent wipes suitable for cleaning equipment. During preparation, nurses follow proper greeting and identification procedures while explaining the blood sampling process to the patient. Care is taken to ensure accurate timing and proper management of the skin prick procedure, including hand disinfection. If the patient's fingertips are hardened or bleeding poorly, techniques such as warming the hands or a gentle finger massage are employed. The nurse verifies the correct storage and expiration date of test strips, as well as the calibration of the blood glucose meter before setting up the sampling equipment. Protective gloves are worn when taking blood sample (Rautava-Nurmi et al., 2019.)

Before measuring blood glucose, the healthcare provider also interviews the patient to understand any factors that could affect the blood glucose values. One crucial aspect is determining when the patient last ate. If the goal is to measure fasting blood sugar, it's critical to monitor blood glucose timely while ensuring that the patient follows nutritional guidelines (Eskelinen 2016.)

Hand hygiene and glove usage: before initiating the procedure, ensure proper hand hygiene using the disinfection method. Once hands are clean, wear disposable gloves to prevent contamination during sampling (Picture 1.)

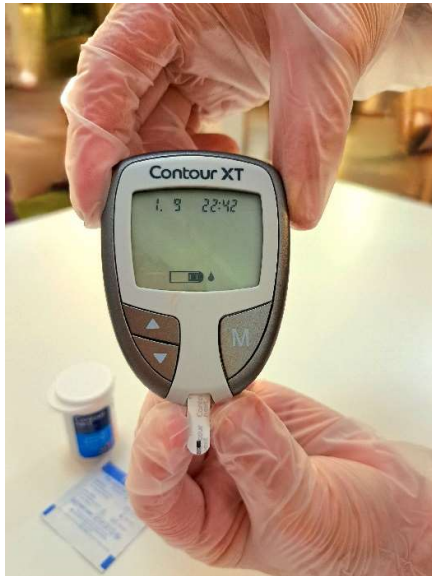


Picture 1. Hand washing and drying (Verensokerin Omaseuranta, 2019)

**Assemble Equipment:** When assembling the equipment for blood glucose measurement, it's crucial to follow a systematic approach that ensures accuracy and safety. Begin by preparing the lancet device for pricking and adjusting it to the puncture depth instructed by the manufacturer. After calibrating the glucometer, carefully insert the test strip, making sure to avoid any contact with the strip's sensor area. Always adhere precisely to the manufacturer's guidelines when inserting the strip into the glucometer (Rautava-Nurmi et al., 2019.)

**Strip to the device:** The reagent strip is handled using clean, dry fingers and inserted into the meter's designated strip port. The area on the strip where blood absorption occurs remains visible. Proper insertion initiates the meter, while debris on the strip port can hinder its operation. (Verensokerin Omaseuranta, 2019.)

Gently insert the strip into the glucometer device as per the specified orientation in the instructions. Ensure its fully inserted until the device recognizes the test strip. Once the device displays an image of a blood drop, it's ready for capillary blood sampling, as shown in the (picture 2.)



Picture 2. Inserting test strip into glucose meter

Patient Identification: The sampling procedure always begins with patient identification, which is a crucial factor for patient safety. Patient identity is verified using two identification details, such as the patient's personal identification number and name. The methods and practices for patient identification may vary among healthcare units. The utilization of barcodes reduces identification errors and enhances patient safety. (Client and Patient Safety - Ministry of Social Affairs and Health, 2018.)



Picture 3. Patient identification (Client and patient safety Ministry of social affairs and health, 2018)

Selection of puncture site: The site selection for capillary blood glucose sampling is critical to ensure accurate and reliable results while maintaining patient comfort and safety. When choosing the sampling site, opt for the side of the fingertip, specifically the ring or middle finger. These areas tend to have an adequate blood supply and are less sensitive than fingertip pads. Avoid bruised or scarred areas: Ensure the selected finger has not bruised, inflamed, or scarred areas. These regions may affect blood flow and cause discomfort to the patient. Do not select a hand with an ongoing intravenous (IV) infusion. This helps prevent interference with the accuracy of the blood glucose reading. (Krlieza et al.,2015.)



Picture 4. Puncture site (Rautava-Nurmi et al., 2020, pp. 267–269)

Cleansing and disinfection: Cleansing and disinfection are integral steps within the capillary blood glucose sampling process, ensuring both accurate results and patient safety. Before proceeding with the puncture, it is crucial to meticulously cleanse the selected puncture site. An alcohol-based cleansing agent is often employed, removing any contaminants from the skin's surface. Subsequently, the site should be allowed to dry completely, preventing any dilution or interference with the blood sample. Hold the alcohol-infused swab with one hand. Then, select the pricking finger with the other hand. Gently swipe the swab across the tip of the chosen finger. Ensure complete coverage of the pricking area with just one downward wipe, and wait a few seconds for the alcohol to evaporate completely. Following these straightforward steps guarantees the safe and effective use of the alcohol-infused swab for cleansing the pricking site. (Ergin E & Zaybak A, 2022.)



Picture 5. Cleansing and disinfection of puncture site

Puncture technique: The puncture technique for capillary blood glucose sampling involves a secure grip on the patient's hand to engage the fingertip. A single, brisk puncture is made to the side of the fingertip because side of the finger has less nerve supply compared to the tip of finger and taking care to avoid the area near the nail. Positioning the limb downward helps enhance blood flow during the puncture process, aiding in a steady and efficient blood collection process. (Tuokko S et al., 2009.)



Picture 6. Puncture technique (Rautava-Nurmi et al., 2020, pp. 267–269)

Collecting the sample: In healthcare settings, nurses often use capillary blood to measure blood glucose levels, and patients frequently do the same at home. However, it is essential to note that there are specific procedures for testing

with the first or second drop of blood (Palese et al., 2016). As per nursing literature, clinical nurses must ensure precise, prompt, and secure blood glucose measurements. Before taking the capillary blood glucose measurement, the recommended first procedure involves disinfecting the hands. Next, select the patient's finger pricking site and clean that area with an alcohol-infused swab. Allow it to dry, and then use a lancet device to prick the finger. Afterward, wipe away the first drop of blood and use the second drop for testing. (Ergin E & Zaybak A 2022.)

The first blood drop might carry traces of the disinfectant, potentially leading to incorrect readings and impacting the sample's quality. Applying gentle pressure near the puncture spot can aid in the smooth flow and collection of the second drop. An adequately sized droplet is essential to activate the glucose meter and ensure precise outcomes. Overly pressing on the finger tissue can result in discomfort, bruising, scars, the formation of a hematoma, or dilution of the sample with serous fluid. (Mathew et al.,2023.)



Picture 7. Initial step of collecting sample.

Sample collection and disposal are essential aspects of the capillary blood glucose sampling process, ensuring not only accurate results but also maintaining safety and hygiene. As the capillary blood is obtained, it is carefully

collected on the test strip reagent. To prevent further bleeding, a band-aid plaster is applied on to the puncture site, promoting clot formation. Once the sample has been successfully obtained, proper disposal of the lancet is paramount. The used lancet is discarded into a designated sharps container, ensuring safe disposal and minimizing the risk of injuries. To complete the process, the hands are sanitized using a hand sanitizer, emphasizing the importance of maintaining cleanliness and minimizing the risk of cross-contamination. (Rautava-Nurmi et al., 2019.)

Patient education and documentation: Within the framework of capillary blood glucose analysis, patient education assumes paramount importance as it empowers individuals to actively partake in their healthcare management. Patient education plays a crucial role in alleviating patient apprehensions, ensuring compliance, and facilitating a seamless procedure. Educating patients about the significance of adhering to fasting guidelines, medication protocols, and the warming of the puncture site can enhance the accuracy of results. (Kuusisto et al., 2014.)

Documentation stands as an indispensable companion to patient care, constituting a reliable record of the entire procedure and its outcomes. A meticulous and comprehensive documentation process encompasses key details such as the date, time, patient identification particulars, location of sample collection, and any pertinent observations made during the procedure. This repository of information contributes to continuity in patient care and empowers healthcare practitioners to monitor glucose level trends, thereby facilitating the customization of treatment strategies. Thorough documentation also extends to recording the identity of the practitioner executing the procedure and any additional contextual annotations. Adhering to rigorous documentation practices not only ensures the delivery of quality care but also promotes effective communication among healthcare providers. (Kuusisto et al., 2014.)

Factors affecting measurement reliability: Blood sugar measurement reliability can be compromised by several factors. According to Rautava-Nurmi et al.

(2020), physiological variations, such as squeezing fingertips too much, fingertips are dirty and dry, expired strips, meter is not calibrated. Inadequate and insufficient sample amount due to wrong techniques. (Rautava-Nurmi et al., 2020, pp. 267-269.)

Addressing these challenges requires comprehensive strategies, encompassing patient education, standardized procedures, proper device maintenance, and regular quality control assessments. By identifying and mitigating potential error sources, healthcare providers can enhance blood sugar measurement reliability and improve diabetes management outcomes. (Rautava-Nurmi et al., 2020, pp. 267-269.)

## 2.5 PowerPoint as educational material

Power point is a useful educational tool for students studying nursing. Create instructional resources for nursing students using PowerPoint to help them see and comprehend difficult ideas linked to capillary blood glucose analysis and POCT. According to Harden and Davis (2018), PowerPoint presentations including photos, diagrams, and videos can improve nursing students learning and the results for patients with diabetes.

Both writers adhered to the SAMK guidelines while crafting their PowerPoint slides, in alignment with the provided SAMK PowerPoint template. Additionally, they employed theoretical insights pertaining to the development of effective educational content when designing their presentation slides.

## 3 PURPOSE AND OBJECTIVES OF THE PROJECT

The purpose of this project thesis was to produce educational material using a PowerPoint presentation focusing on capillary blood glucose measurement as a point-of-care test guide for nursing students at SAMK.

The objective of this thesis was to enhance nursing student's skills in monitoring the patient's blood glucose. The cooperation partner for this project is SAMK.

## 4 IMPLEMENTATION OF THE PROJECT

### 4.1 Methodology

In a project thesis, the theoretical description of the method means, when writing a project thesis, it's essential to provide a clear and detailed description of the methods used in the thesis process. This includes explaining why authors chose specific methods, outlining the thesis design, selecting the sample, collecting data using appropriate tools and procedures, and analysing the data thoroughly. It's also crucial to highlight the steps taken to ensure the accuracy and reliability of the study. This section helps readers understand the methods used and evaluate the credibility and validity of the findings. (Rudestam, K. E., & Newton, R. R 2014.)

The Waterfall Method is a linear and sequential approach to project management that consists of a series of distinct phases, including planning, design, implementation, testing, and maintenance (Salleh & Alias, 2016). In the context of developing educational materials for nursing students on POCT for capillary blood glucose measurement, the Waterfall Method can be used to guide the project from start to finish, ensuring that each phase is completed before moving on to the next.

The utilization of the waterfall method for this project offered several benefits. Firstly, it ensured the development of educational materials in a systematic and structured manner, thereby preventing errors and ensuring their effectiveness. Secondly, the Waterfall Method aided authors in completing the project

on time and within budget, a crucial aspect for educational institutions with limited resources. Lastly, the Waterfall Method provided nursing students with valuable experience in project management, which could prove beneficial for this project.

#### 4.2 Description of the target group

SAMK's internationally nursing program attracts students from diverse cultural and ethnic backgrounds worldwide. The program was initiated in the Autumn of 2017 with a cohort of 25 students, and since then, a new group of international nursing students has been enrolled every year. This consistent growth has led to the ongoing development and enhancement of the international nursing program, which aims to prepare students for a valued profession. Upon graduation, students are expected to work with clients from different groups to promote health and well-being. SAMK's nursing education prioritizes ethical principles, comprehensive and multidisciplinary knowledge, practical skills, and interaction skills to develop professional competencies in nursing. (SAMK, 2020.)

The practical training introduces the student to essential practical tasks, especially professional skills, and applying knowledge and skills in professional work. The practical training can be completed in the private or public sector, as an entrepreneur, or in another separately approved working environment, fulfilling the set criteria in Finland or abroad. (SAMK, 2020).

#### 4.3 Literature retrieval and previous studies

Conducting a literature retrieval is an essential process of a project thesis, as it allows for the exploration and identification of existing knowledge and discussions relevant to the topics of the study. The primary objective is to gather and analyse the best available evidence-based knowledge to present a comprehensive and informed final product (Chigbu, Atiku, & Du Plessis, 2023.)

The literature retrieval of this project explored reliable information related to point-of-care capillary blood glucose measurement. The objective of this thesis was to enhance nursing student's skills in monitoring the blood glucose of a patient. aim was to enhance patient care and outcomes. The authors gathered data from various evidence-based sources, including electronic databases like PubMed, CINAHL, Google Scholar, Ovid, Science Direct, and SAMK Finna, to conduct this educational material outcomes. The authors considered following Finnish sources and guidelines for gaining a comprehensive understanding of the healthcare system in Finland. The data was collected from various sources in Finland, because the target group will be working in Finland

The keywords used to search are such as capillary blood glucose, point-of-care testing, accuracy, analytical performance, quality control, blood glucose variability, infection control on blood glucose meters, professional practice standards, guidance using a blood glucose meter, fingerstick, glucometer maintenance, nursing students, strip insertion, handling of the strip, hand hygiene, puncture technique, the timing of measurement, reading of results, safety instructions.

#### 4.4 Project stages and schedules

The project management process adheres to a systematic framework encompassing various stages, ensuring a smooth progression from project initiation to ultimate completion. These stages—initiation, planning and design, implementation, testing, maintenance, verification, and closure—have their designated timelines and deadlines, providing clear guidance throughout the project's lifecycle (Project Management Institute, 2017.)

This thesis project follows a specific timeline and is completed in several stages. The initiation stage of project requirements and gathering started with selecting a project thesis topic based on point-of-care testing (POCT), the target group was samk nursing students. The tasks included developing a thesis report, understanding the concepts of research methods and SAMK thesis

guidelines, and learning how to create educational material for nursing students through seminars; the ethical guidelines of TENK were adhered to. Materials requirements were identified, such as a computer, internet access, a notebook, and other vital resources authorized search engine database to find evidence-based materials.

The next stage of the project involved planning and design. The authors identified the correct project title based on point-of-care testing (POCT) for patient capillary blood glucose measurements. The tasks were specified, and timetables were planned through collaboration with stakeholders. The authors selected academic content relevant to the thesis topic and identified the project's goal, which centered on producing educational material for nursing students of SAMK based on capillary blood glucose measurement. The team decided to develop a PowerPoint presentation as the product outcome and addressed any concerns through collaborative meetings with each other, as well as by considering suggestions from the thesis supervisor.

The most challenging stage was the implementation of the project. The authors collected well-grounded, evidence-based literature information for the theoretical background from various approved resources and analyzed the approved databases for the project implementation. The authors also engaged in progress discussions of the project and sought feedback from the supervisor to make better improvements. Throughout the whole process, documentation was maintained to avoid unnecessary outcomes.

The testing phase, where the authors and supervisor assessed the quality, reliability, and validity of the evidence-based sources' findings related to capillary blood glucose measurement and created beneficial educational material for nursing students. During the testing phase, the authors also ensured that the thesis project was aligned according to the purpose and objective of the project. All other project improvements were considered under evaluation by the supervisor and for the approval of the final thesis project.

The final step of this project was verification and submission. The authors thoroughly assessed the project's work and received the final approval from their thesis supervisor. The goal was not only to finish the project and create an up-to-date, informative, and well-designed product. The authors developed a structured PowerPoint presentation that guides nursing students in the correct capillary blood glucose measurement procedures. The intention is to ensure that future nursing students at SAMK can benefit from this product.

The project team ensured that each phase of the project was completed before moving on to the next by following the waterfall method, as shown in Table 1.

Table 1. Stages of the project, activity, and timeline

Name of the stages	Activity	Time
Initiation stage	Collected and gathered of the requirements.	August 2021
Planning and design	Planned tasks in collaboration with stakeholders, selected relevant academic content, set the goal of producing educational material for SAMK nursing students, opted for a PowerPoint presentation as the final product, and addressed concerns through team meetings and guidance from the thesis supervisor.	March 2023
The implementation stage	The theoretical background has collected from evidence-based literature from approved resources, analysed project implementation through authorized databases, engaging in progress discussions, seeking supervisor feedback, and maintained documentation to ensure effective outcomes.	April-May 2023
The testing stage	Evaluated evidence-based sources on capillary blood glucose measurement, producing valuable educational material for nursing students, aligning	May-June 2023

	the project's purpose, and seeking supervisor approval for final project enhancements	
Maintenance	The authors meticulously reviewed and gained thesis supervisor approval for their well-designed PowerPoint presentation, aiming to provide contemporary guidance for proper capillary blood glucose measurement to benefit future SAMK nursing students.	August 2023
Verification & closure	Submission of final thesis after verification by supervisors.	September 2023

## 5 EVALUATION

The thesis project process was evaluated, and feedback was received from the supervisor teacher at SAMK. The authors also assessed each other's work, providing constructive feedback and sharing ideas. The project aimed to increase nursing students' knowledge about the proper capillary blood glucose measurement procedures, which enrich their skills and competencies, and utilize the project material for self-study. The feedback, including an evaluation from the SAMK thesis team, indicated overall satisfaction with the project. The initial PowerPoint presentation was revised to be more concise and aligned with the SAMK thesis template.

### 5.1 Resources

The project resources typically include human resources, time, capital, materials or supplies, and literary resources, which are necessary to effectively manage and complete a project. Essentially, project resources are what a project relies on to accomplish its objectives and goals (Eubanks, 2017).

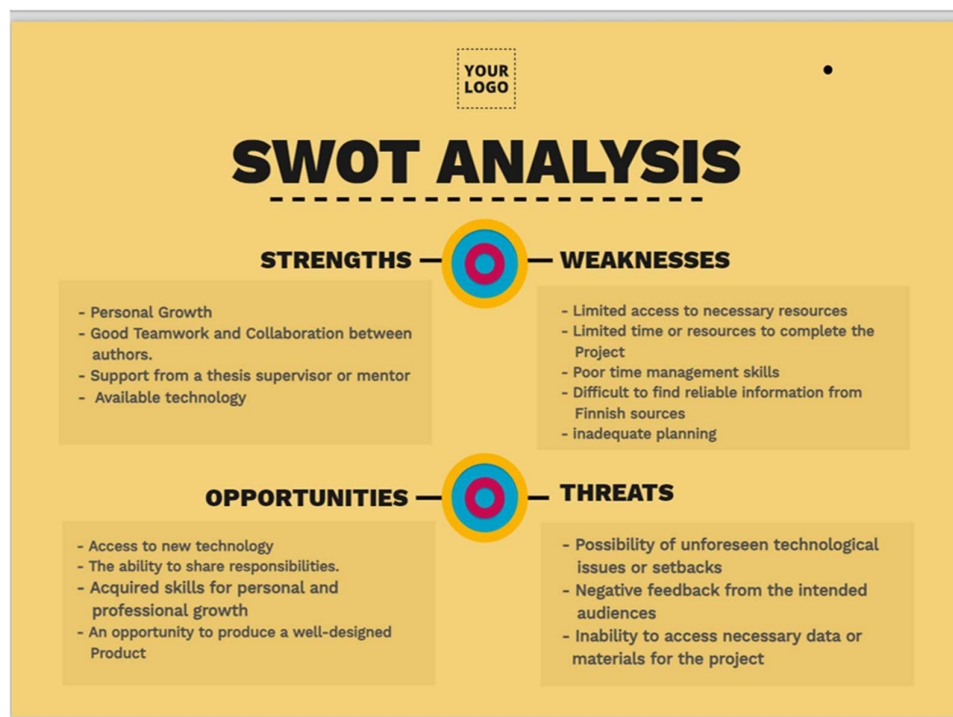
The resources needed for this thesis project included evidence-based information, such as articles, books, Samk Finna, Samk Library, PubMed, Google Scholar, EBSCOhost, and other databases. The authors also watched videos to understand the chosen topic comprehensively. The authors also required resources like laptops and phones with internet access. They regularly met with their supervisors to discuss project progress, plan upcoming stages and tasks, and evaluate completed work. The potential use of the SAMK nursing simulation room was hindered by the summer break, prompting the authors to capture images within the Manionkoti Pori workplace. The availability of blood glucose measurement equipment across various healthcare facilities necessitated this. At the same time, other pictures with approval rights were obtained online.

## 5.2 Risks

The authors acknowledged multiple risks that hindered the successful completion of a thesis project. Poor time management caused stress and missed deadlines and negatively affected the quality of work. Technical issues, like problems with equipment, software, or data, caused delays and disrupted the timeline. Other risks included limited resources, writer's block, health problems, and data accuracy. Overcoming these risks, author required more time, resources, or modifications to the project plan under supervision.

Therefore, when working on a thesis project, it was helpful for authors to conduct a SWOT analysis (Table 2). To assess the strengths, weaknesses, opportunities, and threats associated with the thesis topic or process. This analysis revealed potential obstacles or limitations hindering the project's success and chances for future collaboration. Additionally, it allowed the authors to identify their strengths and weaknesses, which informed their approach to overcoming challenges and achieving their goals. (Teoli, D., Sanvictores, T., & An, 2022.)

Table 2. Swot analysis of this thesis



### 5.3 Ethics

The authors of this thesis project followed ethical guidelines for proper scientific practice. They maintained honesty and responsibility while presenting their project's data, materials, and sources, following the ethical rules and instructions outlined in the Satakunta University of Applied Sciences thesis agreement. The author precisely identified trustworthy sources and received approval and particular guidance for the final product from their thesis supervisor for capillary blood glucose measurement (SAMK, 2019.)

All the materials used in this thesis project were documented, cited according to the instructions of samk. The authors collected up-to-date scientific materials and sought theoretical information from trustworthy sources while following the guidelines of the Finnish National Board on Ethics in Research (TENK). By doing this, the authors guaranteed that the project adhered to the highest ethical and quality standards and avoided any misconduct, such as fabrication, plagiarism, falsification, or misappropriation in their thesis projects.

Furthermore, the authors kept up to date with the latest scientific evidence-based updates on the quality Point-of-Care Test (POCT) test, which assisted the authors in adhering to the project plan and fulfilling the objective of the final product ethically. The authors strictly adhered to the guidelines set forth by their educational institute SAMK. This project thesis was conducted without biases toward any group or community. The authors were familiar with rules and regulations and followed SAMK ethics guidelines and standards.

## 6 CONCLUSION

Nursing education plays a pivotal role in equipping healthcare professionals with the knowledge and skills required for precise and empathetic patient care, including capillary blood glucose analysis. This critical aspect of diabetes management demands meticulous training to ensure accurate results while minimizing discomfort for patients. Through comprehensive education, nurses learn to perform capillary blood glucose tests effectively, understanding the significance of timing, technique, and proper documentation.

Furthermore, nursing education extends beyond the technical aspects, emphasizing the importance of patient education and communication. Nurses learn to not only conduct tests proficiently but also to explain the procedure to patients, allaying their concerns and fostering a collaborative approach to their care.

By embracing the complexities of capillary blood glucose analysis within nursing education, future healthcare professionals are prepared to provide holistic care to individuals with diabetes. This comprehensive training empowers nurses to contribute significantly to the management of diabetes, promoting patient well-being through accurate testing, informed counselling, and compassionate interaction.

## 7 DISCUSSIONS

The thesis proceeded positively and smoothly with effective teamwork between authors, a well-defined project plan, and excellent communication, support from the supervising teacher. However, certain aspects could have been learned and improved during the thesis. The authors needed to gain prior experience in estimating the duration of each thesis task, leading to the need for more time than initially planned.

This project provides the nursing students of SAMK with good educational material and instructions on performing quality point-of-care tests in capillary blood glucose measurement. Using this PowerPoint presentation product, nursing students gain updated information and skills to follow the correct procedures of capillary blood glucose measurement. Patient safety also increased through this method, as evidenced-based shows. Additionally, this project offered the nursing students reliable learning material, contributing to SAMK's provision of qualified education.

There are always new improvements in point-of-care test technology devices, such as continuous glucose monitoring (CGM) devices, used in all healthcare settings for blood glucose measurement. Suggestions for further studies on this topic involve researching the long-term effectiveness and patient benefits, regardless of the current information presented by the authors. However, Glucometer devices are still widely used in healthcare settings for several valid reasons, including rapid results, portability, cost-effectiveness, patient empowerment, and user-friendliness for healthcare professionals, nursing students, and educated patients who can self-monitor at home under Guidance. Glucometer devices play a crucial role in better diabetes management by facilitating adjustments to lifestyle and medications accordingly.

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## APPENDIX.1



## Slide 1

## CONTENTS

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- Introduction to POC capillary blood glucose monitoring and its purposes
- Preparation: Hand hygiene and equipment
- Performing the finger pricking method and choosing the right puncture site
- Blood Collection: Using a test strip
- Interpreting readings
- Factors affecting accuracy
- Conclusion and References

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## Slide 2

## Introduction

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- Point-of-care testing (POCT) is a term used to describe diagnostic testing that is carried out at the patient's bedside or a healthcare provider's office. This type of testing is quick and convenient, and results are available immediately. To improve patient outcomes, POCT enables healthcare professionals to modify treatment strategies in real-time in response to precise and timely test results (Celi et al., 2020.)
- A typical POCT for managing diabetes is capillary blood glucose analysis, which enables quick and precise assessment of blood glucose levels using a small amount of capillary blood acquired through a finger prick. Capillary blood glucose analysis enables healthcare professionals to modify insulin dosages and other treatment strategies in real time based on accurate and timely measurements (Haupt et al., 2021.)

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### Slide 3

## Hand hygiene and asepsis

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Before initiating procedures, nurses must adhere to hand hygiene protocols:

- Crucial in health care safety
- Ensure hands are washed and dried properly
- Hand disinfection is essential for accurate results in point of care capillary blood glucose

(Rautava-Nurmi et al., 2019 & Verensokerin Omaseuranta, 2019)

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### Slide 4

## Required materials for capillary blood glucose measurement

Prior to conducting the capillary blood glucose measurement, the nurse organizes all the essential materials (Rautava-Nurmi et al., 2019).

- An alcohol swab
- Blood glucose meter
- Test strips
- Lancet
- Sharps disposable container
- Sterile gauze
- Disposable gloves
- Germicidal disposable wipes
- Adhesive plaster
- Hand disinfection



Source: Rautava-Nurmi, hoitotyön taidot ja toiminnot

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### Slide 5

## Patient Identification

The sampling procedure always begins with patient greetings and identification, which is a crucial factor for patient safety. Patient identity is verified using two identification details, such as the patient's personal identification number and name. The methods and practices for patient identification may vary among healthcare units. The utilization of barcodes reduces identification errors and enhances patient safety (Client and patient safety Ministry of social affairs and health, 2018.)

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### Slide 6

## Finger prick method and accurate puncture site

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- Opt for the ring and middle finger on the distal sides of the fingertip, as they have fewer nerve endings compared to the tips and a greater depth of tissue beneath the skin.
- The thumb or index finger could be more susceptible to calluses or scars and heightened sensitivity, potentially leading to increased discomfort during the procedure.
- The little finger lacks sufficient tissue to prevent the lancet from coming into contact with the bone

(Rautava-Nurmi et al., 2019)



Source: Rautava-Nurmi, Hoitotyön taidot ja toiminnot

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### Slide 7

## Continue...

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- Before pricking, position the patient so they are seated or reclined comfortably.
- Once the appropriate puncture site is selected on the sides of the fingertip (middle or ring finger), disinfect the sampling site using an alcohol swab/pad.
- Allow the site to air dry completely before proceeding. DO NOT touch the area again.

(Rautava-Nurmi et al., 2019)

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### Slide 8

## Method of using a lancet device

- Hold the lancet between the thumb and forefinger of your dominant hand perpendicular to the skin surface, placing the opening for the blade against the skin at the desired puncture site. Depress the plunger with your index finger and then release the plunger allowing the blade to retract. Remove the device from the puncture site and discard the lancet in the designated sharps container. Note: There are different types of lancets, follow according to the manufacturer's instructions.



(Rautava-Nurmi et al., 2019)

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### Slide 9

## The method of capillary blood sample collection

- Disinfectant alcohol may contaminate the initial blood drop, potentially leading to inaccuracies in the test result and affecting the blood sample.
- Use a sterile gauze pad to remove the first blood drop. Collect the sample exclusively from the second, adequately sized drop of blood.
- Applying gentle pressure near the puncture site can facilitate blood flow.
- Always remember to gently squeeze the finger. Avoid applying excessive pressure (milking) to prevent hemolysis and specimen contamination.
- Position the strip horizontally over the blood drop, enabling efficient absorption of the blood enough to cover the test pad on the reagent strip.

(Rautava-Nurmi et al., 2019.)



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### Slide 10

## Continue...

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- After sampling, use a clean gauze pad to apply pressure to the puncture site until the bleeding stops or instruct the patient to do so.
- Wait a moment and read the result from the meter, afterward place a band-aid on the puncture site.
- Take off the protective gloves and disinfect your hands.
- Tell the patient measurement result and give the results in hand if necessary in matters related to blood sugar.
- Record the measurement result, documentation is essential and if necessary inform the doctor or a diabetes nurse.

(Rautava-Nurmi et al., 2019)



## Slide 11

### Sharps disposal container

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Always dispose of used lancets and test strips in the designated sharp container to minimize the risk of injuries and infections from sharps

(Rautava-Nurmi et al., 2019.)



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## Slide 12

## Common causes of inaccurate capillary blood glucose measurements

The key factors that can affect the accuracy of blood glucose measurement include:

- Excessively compressing the patient's finger
- Obtaining samples from fingers that have not been adequately disinfected and dried
- Using expired strips during sampling
- Failing to properly calibrate the meter according to instructions
- Improper storage of meters or test strips
- Inadequate collection of blood samples from the puncture site.
- Possible substances include alcohol gel or wipes for finger cleaning, residues from newspaper print, perfumes, hand creams, hairspray, hair gel, lubricants, and traces of food and drink.
- Failing to adhere to the accurate timing of procedures

(Rautava-Nurmi et al., 2019 & American Diabetes Association 2019)

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### Slide 13

## Normal blood sugar target levels

Blood sugar is the measurement of concentrated glucose within the bloodstream. The average reference values for fasting blood sugar derive from plasma, ranging between 4-7 mmol/L, while post-meal readings two hours later should remain under 8-10 mmol/L. A measurement below 3 mmol/L indicates hypoglycemia, whereas a value surpassing 10 mmol/L signifies hyperglycemia. Blood sugar targets remain distinctly individual. Additionally, the doctor implements specific treatment plans for changes in blood sugar levels based on the patient's case.

(Rauta Nurmi et al., 2019.)



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### Slide 14

# References

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