Arab American University

Faculty of Graduate Studies

The Knowledge, Perception, and Attitudes of Healthcare Professionals toward the Use of Subcutaneous Fluids in Elderly patients in Northern Palestine

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This thesis was submitted in partial fulfillment of the requirements for the Master's degree in Adult Nursing
June / 2024

Thesis Approval

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Declaration

I declare that this thesis was composed by myself and that the work contained herein is my own, except where it states otherwise by references or acknowledgment, the work presented is entirely my own.

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Dedication

This thesis is dedicated to the loving memory of my father, whose presence and guidance I deeply miss every day; and to my mother, whose unwavering support and encouragement have been my foundation throughout this journey. Your sacrifice and love have been my greatest inspiration. I also extend my heartfelt gratitude to my supervisor, Dr. Mohammed Jallad, for his invaluable guidance, patience, and support. Without your wisdom and mentorship, this work would not have been possible.

Omar Hwayel

Acknowledgment

First, I give all the glory to Allah, the source of our strength, for blessing me with both the mental and physical endurance and tolerance to complete this monumental task.

I have taken great efforts in this project, but it would not have been possible without the kind collaboration and help from various individuals and institutions. I would like to express my deepest gratitude to the healthcare providers in the hospitals of Northern Palestine for their time and participation in this research. Their contributions were invaluable and significantly impacted the success of this study.

I am sincerely thankful to my main supervisor, Dr. Mohammad Jallad, for his professional and careful scientific guidance, generous support, and for providing excellent working conditions throughout this project. Additionally, I would like to extend my appreciation to all my colleagues, students, teachers, and doctors at the Arab American University for their support and encouragement.

Lastly, but most importantly, I am eternally grateful to my family. To my mother, for her sacrifices, love, and understanding, and to the memory of my late father, whose spirit has always been a source of strength for me.

Omar Hwayel

Abstract

Background: Subcutaneous fluid administration, known as hypodermoclysis, is an alternative method for delivering fluids, especially in elderly patients. This method is gaining recognition for its simplicity, cost-effectiveness, and minimal invasiveness compared to traditional intravenous routes. Despite the well-documented benefits of subcutaneous fluid administration in elderly patients, its adoption is limited due to varying levels of knowledge, perceptions, and attitudes among healthcare professionals

Objectives: The primary objective of this study is to assess the knowledge, perception, and attitudes of healthcare professionals in Northern Palestine towards the use of subcutaneous fluids in elderly patients.

Methodology: This cross-sectional study was conducted in Northern Palestine and involved healthcare professionals from various hospitals. Data were collected through a self-administered questionnaire that assessed participants' knowledge, perceptions, and attitudes towards subcutaneous fluid administration. The analysis included evaluating the mean scores of knowledge and attitude items and exploring potential demographic influences.

Results: The sample primarily consisted of nurses (60.4%) and males (58.5%). A significant proportion of the participants were aged 21-30 years (56.7%), held a Bachelor’s degree (78.7%), and had 1-5 years of professional experience (32.3%). The average knowledge score on subcutaneous fluid administration was 62.3% ± 19.6%, with 45.7% of participants demonstrating low knowledge levels and 37.8% showing moderate knowledge. Notably, doctors and allied health professionals had significantly higher knowledge scores compared to nurses ($p = 0.002$). Additionally, 53.2% of doctors and 38.9% of allied health professionals exhibited moderate knowledge levels, with 21.3% of doctors showing high knowledge levels ($p = 0.011$). Attitude

scores towards subcutaneous fluid administration were generally positive, with a mean score of 81.6% ± 12.4%. Approximately 67.7% of participants had a good attitude, and 29.3% had an acceptable attitude. Higher educational levels correlated with more positive attitudes towards subcutaneous fluid administration ($p = 0.022$). The most frequently reported barrier was the lack of adequate training, especially among nurses, where 51.8% identified it as a major obstacle. No significant correlation was found between knowledge and attitude scores ($p = 0.097$), suggesting that knowledge and attitude towards subcutaneous fluid administration may operate independently in this population.

Conclusions: The findings underscore the necessity for targeted training programs to enhance the knowledge and attitudes of healthcare professionals towards subcutaneous fluid administration in elderly patients. Addressing these educational gaps is crucial for improving clinical practices and patient care outcomes in the management of hydration for the elderly.

Keywords: Subcutaneous Fluid Administration, Elderly Patients, Healthcare Professionals, Northern Palestine.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

Abbreviation	Full Term
AAUP	Arab American University of Palestine
HCPs	Healthcare Professionals
IV	Intravenous
SC	Subcutaneous
HDC	Hypodermoclysis
NS	Normal Saline
SCRT	Subcutaneous Rehydration Therapy
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization
SD	Standard Deviation
ANOVA	Analysis of Variance
ICU	Intensive Care Unit

Chapter One

1.1 Introduction

The ageing of the global population is the most important medical and social demographic problem worldwide (Padeiro et al., 2023). The World Health Organization has defined healthy ageing as a process of maintaining functional ability to enable wellbeing in older age (Rudnicka et al., 2020). According to the World Health Organization by 2030, 1 in 6 people in the world will be aged 60 years or over. At this time the share of the population aged 60 years and over will increase from 1 billion in 2020 to 1.4 billion. By 2050, the world's population of people aged 60 years and older will double (2.1 billion). The number of persons aged 80 years or older is expected to triple between 2020 and 2050 to reach 426 million (Grinin et al., 2023).

As the global population ages, healthcare systems face increasing challenges in managing the complex medical needs of elderly patients. One significant related issue is the effective management of dehydration (Brunker et al., 2023). Older adults are more vulnerable to dehydration, especially those living with multiple chronic diseases (Li et al., 2023). The elderly are susceptible to dehydration due to age-relat1ed changes in renal concentrating ability, total body water content, functional decline, reduced thirst sensation, and possible side effects of medications (Puga et al., 2018).

Dehydration plays a role in various end-organ damage syndromes, including delirium, acute kidney injury, and cardiac arrhythmia (Swerdel et al., 2017). Furthermore, dehydration negatively impacts the functioning of both blood and tissue cells (Haileka et al., 2019). Dehydration poses significant negative consequences for elderly individuals, leading to an

increased likelihood of hospitalization, disability, infections, falls, acute ischemic stroke, and even mortality (Greene et al., 2018).

Sufficient hydration is crucial for human well-being and is carefully controlled in healthy adults through mechanisms like thirst and urine production. However, this regulation is often disrupted in elderly patients due to a diminished sense of thirst and impaired kidney function (Mantantzis et al., 2020). Among older adults, low-intake dehydration is common, and the most effective preventive measure is ensuring an adequate intake of fluids through drinking (Song et al., 2024) .

Sufficient hydration can be ensured through two distinct methods: oral intake or parenteral infusion. The primary approach to treat dehydration involves replenishing fluids, preferably through oral administration as it is the preferred method. However, in specific situations like cognitive disorders, swallowing challenges, vomiting, and difficulty in breathing (dyspnea), oral administration may not be feasible. In such cases, alternative methods of fluid delivery are necessary (Annes et al., 2020).

Intravenous (IV) fluid administration is a common alternative method that can be employed for rehydration. However, this method carries certain risks, particularly for older adults. Capillary fragility and age-related changes that increase the risk of bleeding, coupled with the frequent loss of the access site resulting in a higher number of catheter insertions, can negatively impact morbidity, comfort, and patient satisfaction (Nunes & Souza, 2016). In addition , unnecessary peripheral venipuncture in elderly exacerbates venous depletion, can lead to physical and psychological trauma (Dat et al., 2021).

The demand for alternative delivery routes for drugs and fluids has arisen from patients facing challenges with venous access or oral intake especially the elderly. An alternative route for fluid administration is subcutaneous (SC) infusion, commonly known as hypodermoclysis (Broadhurst et al., 2023). It involves the infusion of fluids into the subcutaneous space via small-gauge needles that are typically inserted into the thighs, abdomen, back, or arms, in which fluid is slowly absorbed from the subcutaneous tissue to the circulation via the forces of diffusion and perfusion (Caccialanza et al., 2018). This method was first described in 1865 for treating dehydration in patients with cholera in India. Since then, subcutaneous infusion has been used to provide hydration to infants, children, and adults, particularly elderly adults in whom venous access is difficult (Caccialanza et al., 2018).

Hypodermoclysis has been proven to be both safe and efficient, with rare occurrences of complications when healthcare professionals adhere to proper puncture techniques and follow drug dilution and infusion rate guidelines (Deer et al., 2017). Subcutaneous rehydration therapy (SCRT) offers many advantages over IV hydration (Traeger, 2022). It is often much easier to obtain and maintain access in patients who may be dehydrated with collapsible veins, agitated, at risk of pulling out IV lines (Ng et al., 2022). Nursing time to obtain subcutaneous access is less than with IV access (Nishizawa et al., 2020). SCRT does not cause thrombophlebitis and there is less risk of fluid overload than with IV fluid administration. The popularity of SCRT is once again increasing in geriatrics, palliative care, and limited-resource environments (Davies et al., 2022).

1.2 Problem Statement

To the best of my knowledge after reviewing previous literature, this is the first study in Palestine to ever examine the knowledge, perception, and attitudes of healthcare professionals toward the use SCRT. Despite the well-documented benefits of subcutaneous fluid administration in elderly patients, particularly in managing dehydration with reduced discomfort, lower costs, and fewer adverse effects compared to intravenous routes, there exists a significant gap in the utilization of this method in clinical settings (Danielsen et al., 2020). Research has established the effectiveness and validity of this treatment method, which, in some cases, is simpler and more convenient than traditional IV therapy and carries fewer undesirable complications and side effects, especially for elderly patients (Forbat et al., 2017). However, its adoption is limited due to varying levels of knowledge, perceptions, and attitudes among healthcare professionals. Therefore, this study aims to assess the knowledge, perceptions, and attitudes of the health care professional in the Palestinian health services and associated factors toward the use of subcutaneous fluids in elderly patients.

1.3 Study objectives

The main goal of this study is to assess the knowledge, perceptions, and attitudes of healthcare professionals toward the use of subcutaneous fluids in elderly patients in Northern Palestine.

Sub- Objectives of the Study

1. To investigate relationship between certain demographics of health care providers and their ‘knowledge, perception and attitudes towards subcutaneous hydration in elderly patients in north Palestinian hospitals.

2. To investigate relationship between Health care professionals' knowledge, perception and attitudes, and the utilization of subcutaneous fluid administration in elderly patient care.
3. To assess of Health care professionals' perspectives concerning the adoption of subcutaneous hydration as a means of providing fluids to elderly patients.
4. To delve into the factors perceived as hindrances or enablers that impact the acceptance of subcutaneous hydration as an alternative approach to fluid administration.

1.4 Significance of the Study

As the first study of its kind in Palestine, this research is crucial in addressing a significant gap in understanding healthcare professionals' knowledge, attitudes, and perceptions regarding the use of subcutaneous fluid administration in elderly patients within northern Palestinian hospitals. It provides valuable data that can guide future research and foster improvements in clinical practice. Given the unique challenges posed by an aging population, the study's findings offer critical insights into the viability of subcutaneous hydration as an alternative method for fluid administration. By examining healthcare providers' knowledge, perceptions, and attitudes, this study aims to deliver a comprehensive understanding of the factors influencing the acceptance and implementation of subcutaneous hydration. The results of this research could inform the development of targeted educational interventions designed to enhance healthcare providers' competence and confidence in administering subcutaneous fluids. Additionally, the study's contributions to evidence-based guidelines and protocols have the potential to elevate standards of care and improve patient outcomes. Ultimately, the significance of this study lies in its potential to enhance the quality of care for elderly patients and advance healthcare practices in northern Palestinian hospitals.

1.5 Research Questions

This study sought to answer the following questions:

The main research question is: What is the level of healthcare providers' knowledge and perception toward subcutaneous fluid administration in elderly patients in Northern Palestine?

Other questions

1. Do certain demographic characteristics of healthcare professionals influence their knowledge, perception and attitudes towards subcutaneous fluid administration in elderly patients in Northern Palestine?
2. Is there a relationship between healthcare professionals' knowledge, perception and attitudes, and the utilization of subcutaneous fluid administration in elderly patients in Northern Palestine?
3. What are the healthcare professionals' perspectives concerning the adoption of subcutaneous hydration as a method of providing fluids to elderly patients?
4. What factors impact the acceptance of subcutaneous hydration as an alternative approach to fluid administration?

1.6 Conceptual Definition

1.7.1 Knowledge

Refers to the information and understanding that healthcare professionals have about subcutaneous fluid administration, including the procedure, its indications, benefits, risks, and best practices (Zagzebski, 2017) .

1.7.2 Perception

Involves the beliefs and opinions that healthcare professionals hold about subcutaneous fluid administration. This includes how they view its effectiveness, safety, and practicality compared to other rehydration methods (Alonso et al., 2020).

1.7.3 Attitudes

Refers to the predispositions or tendencies of healthcare professionals to respond positively or negatively towards subcutaneous fluid administration. This encompasses their willingness to adopt and advocate for its use in clinical practice (Tseng & Wang, 2023).

1.7.4 Healthcare professionals

Individuals with specialized training and qualifications who are involved in providing medical care, treatment, and support to patients. This includes but is not limited to physicians, nurses, nurse practitioners, physician assistants, pharmacists, therapists, and allied health professionals. They play essential roles in various healthcare settings, including hospitals, clinics, long-term care facilities, and community health centers. They collaborate within interdisciplinary teams to deliver comprehensive care and promote patient well-being (Organization, 2006).

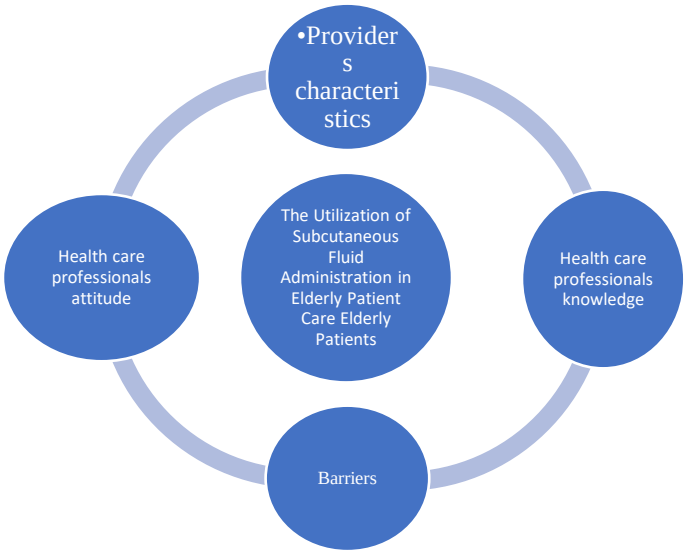
1.7.5 Northern Palestine

Northern Palestine refers to the geographical area comprising the northern segment of historic Palestine. Within this region, healthcare dynamics are intricately interwoven with geopolitical complexities, including occupation and access restrictions, influencing healthcare infrastructure, accessibility, and delivery. Challenges such as limited access in remote areas and disparities in healthcare provision underscore the need for tailored interventions addressing the region's unique socio-political and cultural landscape.

Theoretical framework

The theoretical framework guiding this study has been derived from a comprehensive review of relevant literature. Knowledge-Attitude-Practice (KAP) theory model, one of the most commonly used behavioral intervention theories, is used in this study to explain how knowledge affects behavior. KAP theory model suggests that change in human practice is a gradual process involving the acquisition of knowledge, the subsequent generation of positive attitudes, and finally, the adoption of practice (Wang & Zhang, 2021) .

As depicted in the conceptual diagram below, the knowledge, perception, and attitude of healthcare professionals and patients towards the utilization of subcutaneous fluids in elderly patients are influenced by various factors unique to the Northern Palestine context. Provider-specific factors, institutional dynamics, and cultural considerations are anticipated to play pivotal roles in shaping the perspectives and practices surrounding subcutaneous fluids administration in the elderly population of Northern Palestine.



1.7 Operational Definition

1.8.1 Knowledge

Knowledge is evaluated by computing the mean score of 14 items. Participants are categorized as knowledgeable if they score equal to or greater than the mean score of correctly answered questions, and as not knowledgeable if they score below the mean. The categorization of knowledge levels is as follows: Low, Medium and High.

1.8.2 Perception

For this study, the participants' perception of SCRT is assessed by their awareness, acceptance and apprehension of the importance of SCRT at their hospitals. The perception was addressed by responding to questions from the questionnaire used in this study using a 5-point Likert scale ranging from 0 = ‘strongly disagree’ to 4 = ‘strongly agree’. The perception score would be the average percentage of each participant’s response.

1.8.3 Attitude

Attitude assessment is conducted using eight questions rated on a five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree" (1 to 5). Individual responses are aggregated to calculate total scores, and then the mean score is computed. Participants are categorized as having a good attitude if they score equal to or greater than the mean, and as having a poor attitude if they score below the mean.

Chapter Two

Literature Review

2.1 Introduction

Within the dynamic realm of healthcare, the delivery of fluids and medications through infusion therapy emerges as a pivotal facet of patient management. Time-honored methodologies, especially intravenous routes, have grappled with hurdles, prominently linked to venous access complexities and associated adversities. A transformative trend unfolds, marked by the escalating acknowledgment and adoption of subcutaneous infusion, notably through the avenue of hypodermoclysis (HDC). This innovative approach, characterized by the administration of fluids and medications beneath the skin, holds significant potential, heralding attributes of simplicity, cost-effectiveness, and adaptability across a spectrum of patient demographics. As we delve into the literature, this chapter navigates through the evolution, challenges, and promises surrounding subcutaneous infusion therapy, unraveling a narrative that underscores its transformative impact on contemporary patient care practices.

2.2 Search Strategy

For an exhaustive examination of the literature pertaining to the research topic "Cross-Sectional Study on Subcutaneous Fluid in Elderly Patients at North Palestinian Hospitals," a systematic and targeted search strategy was implemented. PubMed (MEDLINE) and Google Scholar were chosen as primary databases, recognized for their comprehensive coverage of medical literature. Employing carefully selected keywords such as "Subcutaneous Fluid Administration," "Elderly Patients," and "Efficacy of Subcutaneous Hydration," the search encompassed diverse facets, from physiological considerations to clinical applications. Language filters were applied to include only English-language studies, ensuring accessibility and clarity.

While no specific date restrictions were imposed, preference was given to recent studies to incorporate the latest advancements. Inclusion criteria encompassed studies directly addressing subcutaneous fluid administration in the elderly, embracing both quantitative and qualitative approaches. Exclusion criteria were defined to filter out studies unrelated to the research focus and those not specific to elderly populations. Manual searches of reference lists in relevant articles enriched the search strategy, providing a holistic approach to identifying pertinent literature beyond electronic databases.

2.3 Navigating the Shift: Subcutaneous Infusion Therapy as a Paradigm in Modern Healthcare.

Infusion therapy, a frequently employed method for administering medications and fluids in acute and home care, is increasingly becoming prevalent in long-term care. Historically, these parenteral treatments primarily utilized the intravenous route. Nonetheless, the escalating issues of venous depletion pose a significant challenge, particularly with a growing elderly population and patients grappling with enduring complex co-morbidities (Anderson & Shreve, 2004; Dychter et al., 2012; Hawes, 2007). Unnecessary peripheral venipuncture exacerbates the challenges of venous depletion, contributing to both physical and psychological trauma for patients. This, in turn, leads to compromised outcomes related to intravenous procedures, suboptimal utilization of healthcare resources, and escalated costs (Evan Alexandrou, 2014). Moreover, the scope of infusion therapy is extending beyond the confines of acute and home care settings, reaching into hospices and long-term care facilities. Existing vascular access planning are predominantly tailored to acute care scenarios or lack consideration for subcutaneous access options (Chopra et al., 2015; Hallam et al., 2016).

Subcutaneous access involves the insertion of a small catheter into the subcutaneous tissue, facilitating the absorption of infuscate from this space into the circulatory system. This method offers advantages such as the use of a smaller catheter and requiring less technical insertion skills compared to intravenous access, making it applicable in various settings (Caccialanza et al., 2018). Moreover, the catheter placement is quicker, and the likelihood of complications is reduced, leading to potential cost benefits (Moriarty & Hudson, 2001). Despite being in practice since 1865, the adoption of this method has been slow, attributed in part to a lack of familiarity among physicians and healthcare professionals with the technique. Perceived suboptimal outcomes, like hypovolemic shock, have also contributed to hesitancy, often stemming from inappropriate use of hydration solutions (Caccialanza et al., 2018).

2.4 Revolutionizing Patient Care: Embracing Subcutaneous Infusion as a Paradigm Shift in Drug Delivery.

Infusions of medications and fluids are frequently administered in acute and home care settings and are becoming increasingly prevalent in long-term care. Historically, these parenteral therapies have been delivered through the intravenous (IV) route; however, a notable percentage, ranging from 19% to 69%, of peripheral intravenous catheters (PIVCs) experience failure before completing the intended treatment. An unsuccessful Peripheral Intravenous Catheter (PIVC) insertion can result in patient discomfort, dissatisfaction, treatment delays, and the exhaustion of viable venous access (Helm et al., 2019; Murayama et al., 2017). The repetition of attempts to secure venous access not only increases patient pain and distress but also frustrates healthcare professionals, potentially leading to the use of more invasive vascular access devices and posing a risk of harm to the patient (Civetta et al., 2019; Helm et al., 2019). The consequences of catheter failures, including their associated costs, are borne by patients, caregivers, and

healthcare systems. In the elderly population, particularly those residing in nursing homes and long-term care facilities, the subcutaneous route emerges as a valuable alternative in instances of delirium, agitation, or difficulties with venous access. Additionally, subcutaneous infusion is a convenient procedure that can be easily initiated and discontinued to prevent functional decline (Civetta et al., 2019).

The deterioration of a patient's vasculature, compounded by the inexperience and suboptimal decision-making of clinicians during catheter insertion, has prompted a movement to enhance the overall experience and outcomes of peripheral infusion therapy (Armenteros-Yeguas et al., 2017; Hallam et al., 2016). There is a growing necessity for alternative routes for drug and fluid delivery in patients with challenging vascular access, oral intolerance, the preservation of venous health, or situations where oral therapy has proven ineffective (Duems-Noriega & Arino-Blasco, 2015). A viable alternative is the subcutaneous route, recognized for its safety, effectiveness, acceptability, and efficiency in delivering infusion therapy (Annes et al., 2020). Subcutaneous infusions involve the absorption of fluids from the subcutaneous tissue into circulation through the processes of diffusion and perfusion. The recommended shift in practice from direct venous access to the subcutaneous route for various infusions aims to promote vessel health preservation in many patients. However, considering subcutaneous access as a viable option alongside peripheral venous access represents a significant paradigm shift (Caccialanza et al., 2018).

2.5 Innovative Approaches to Fluid Management: Subcutaneous Infusion in Emergency and Palliative Care.

The Clinical Practice Guideline from the Emergency Nurses Association suggests subcutaneous rehydration as a substitute for peripheral IV insertion in mildly to moderately dehydrated pediatric and elderly patients when oral hydration proves unsuccessful (Broadhurst et al., 2023).

This recommendation, graded as level B, signifies a moderate recommendation, indicating moderate clinical certainty with some minor inconsistencies in quality evidence, and is relevant to emergency nursing practice. In the context of palliative care, subcutaneous infusions are commonly employed, particularly towards the end of life, where clinicians opt for the subcutaneous route as an alternative when other routes are deemed inappropriate or unacceptable (Cabañero-Martínez et al., 2019; Dickman & Schneider, 2016). A survey revealed a lack of internationally agreed-upon practice guidelines for the safe administration of fluids and medications through the subcutaneous route (Cabañero-Martínez et al., 2019).

Dehydration, characterized by a decrease in total body water resulting from fluid loss, diminished fluid intake, or a combination of both, is a prevalent complication observed in older adults during hospitalization periods (Begum & Johnson, 2010). The manifestations of dehydration can differ, encompassing dry mucous membranes, diminished turgidity, reduced perspiration, sunken eyes, tachycardia, hypotension, and, in more advanced stages, altered states of consciousness, oliguria, and kidney failure (Shah et al., 2014).

As a result of the widespread adoption of palliative philosophy, hypodermoclysis or subcutaneous fluid administration has become more prevalent in the treatment of mild-to-moderate dehydration, emerging as a secure alternative for delivering fluids and medication (Nunes, 2016). The subcutaneous route is recommended in cases of gastric intolerance, bowel obstruction, diarrhea, mental confusion, agitation, delirium, and severe dyspnea (Annes et al., 2020). It is crucial to change the subcutaneous access site every 7 days for drug infusion and every 24 to 48 hours for hydration solutions. Recommended infusions range from 1.5 to 3 liters per site over a 24-hour period (Rocha et al., 2023).

2.6 Revitalizing Hypodermoclysis: Subcutaneous Fluid Infusion Therapy in Modern Healthcare.

The drawbacks that have been documented include the challenge of swiftly adjusting the volume and speed of the infusion, which, however, closely resemble the adverse events associated with peripheral IV administration (Annes et al., 2020; Souza et al., 2009). The main side effects encompass pain, erythema, phlebitis, fluid overload, edema at the infusion site, and cellulitis, along with more serious but infrequent systemic reactions like infections, hematomas, ecchymosis, hyponatremia, severe edema, and a reaction at the subcutaneous access site (Nunes & Souza, 2016).

Hypodermoclysis or subcutaneous fluid infusion therapy saw extensive use in the first half of the twentieth century. Nonetheless, due to some significant side effects, its utilization was abandoned. This technique involves infusing liquids into the subcutaneous tissue, requiring minimal technology. Presently, it has been reintegrated into clinical practice due to its significant advantages and the growing population of elderly individuals and those with cancer or other comorbidities, necessitating a fresh perspective on care, including palliative and home care (Turner & Cassano, 2004).

The term "Hypodermoclysis" or "subcutaneous therapy" refers to the utilization of the subcutaneous (SC) route for the infusion of fluids and/or medications, either continuously or intermittently. This method is both effective and safe, with rare complications related to SC puncture when professionals employ the correct puncture technique and adhere to drug dilution and infusion rate guidelines (Azevedo & Fortuna, 2017).

Hypodermoclysis becomes a viable option when patients face challenges with the oral route (such as dysphagia, prolonged nausea and vomiting, gastric intolerance, and intestinal

obstruction) or encounter difficulties with venous access due to natural aging of veins and loss of skin elasticity, especially in patients aged over 80 or those who have undergone chemotherapy. Additionally, hypodermoclysis is suitable for individuals experiencing drowsiness, confusion, agitation, and advanced dementia (Guedes et al., 2019; Riegel et al., 2018).

2.7 Empowering Healthcare: Unlocking the Potential of Hypodermoclysis through Education and Integration.

Research has demonstrated several benefits associated with the subcutaneous (SC) route in comparison to the intravenous (IV) route. These advantages include simpler catheter insertion and maintenance, cost-effectiveness, and a reduced incidence of severe complications, particularly puncture-related infections (Nathália Silva Gomes et al., 2017; Vidal et al., 2016a). Furthermore, the flexibility of the SC route enables early patient discharge, allowing individuals to manage symptoms at home. This can be overseen by a trained individual, such as a caregiver or family member (Martins et al., 2020; Vidal et al., 2016a).

The incorporation of hypodermoclysis into clinical practice, fueled by its advantages and the growing population of older adults and individuals with chronic illnesses requiring palliative care, demands a fresh perspective on healthcare. This shift necessitates the adoption of technological options that facilitate drug therapy (da Cunha Silva & dos Santos, 2018; Nunes & Souza, 2016). Despite the compelling evidence supporting its efficacy, the technique has been underutilized in clinical practice due to professionals' limited knowledge on the subject (da Silva Constante et al., 2021). The deficiency in professionals' understanding of the key aspects involved in its application stands as a significant factor contributing to the low implementation of hypodermoclysis in health services (Turner & Cassano, 2004).

For its integration into care and its contribution to drug therapy, it is crucial to provide professional teams with the essential tools and knowledge. This can be achieved through comprehensive training or ongoing updates and in-service training. A study suggests that the lack of knowledge about the subject among medical and nursing professionals may be linked to insufficient discussions on the topic in universities (Guedes et al., 2019; Santos et al., 2020). Addressing the challenge of training human resources that align with healthcare demands is a task for educational institutions. Even within the realm of professional training, there is a need to expand beyond traditional drug administration techniques (Santos et al., 2020).

Moreover, the concept of in-service education, characterized by its dynamic and ongoing nature in knowledge development, should be taken into account. By identifying and addressing qualification needs arising from critical issues in the daily operations of services, this process facilitates changes in approaches to healthcare delivery. It ensures the applicability and relevance of established content and technologies, thereby imbuing new significance into health and nursing practices (Cordeiro et al., 2023).

2.8 Hypodermoclysis in Pediatric Dehydration: A Subcutaneous Solution for Critical Challenges.

Critical emergencies in children under the age of 5 primarily result from gastrointestinal disturbances (Sendarrubias et al., 2018). Annually, an estimated 760,000 children globally succumb to diarrheal diseases, with dehydration being the predominant complication in these cases (Saganski & de Souza Freire, 2019; Sendarrubias et al., 2018). Dehydration involves the loss of both body water and electrolytes. Due to their higher metabolic rate, children require a greater volume of water than adults to maintain fluid balance, making them more susceptible to rapid fluid loss and decreased intravascular volume (Saganski & de Souza Freire, 2019). To

confirm the diagnosis of dehydration, a healthcare professional conducts a physical examination to assess its severity and underlying cause. Severity is typically categorized as severe, some dehydration, or no dehydration (Organization, 2013).

Fluid replacement to address dehydration is typically administered through the oral and intravenous (IV) routes, but these methods have their limitations. The oral route is not suitable for patients experiencing persistent nausea or vomiting. On the other hand, the IV route, although effective, is a complex procedure not recommended for children due to their increased capillary fragility. Children have smaller blood vessels that are more challenging to visualize or palpate compared to adults, making the IV route less preferable in this population (Larsen et al., 2010; Negri et al., 2012).

Hypodermoclysis (HDC) is a method employed for the infusion of fluids and electrolytes through the subcutaneous tissue, recommended for patients experiencing mild to moderate dehydration and facing contraindications to oral administration or challenges with venous access (Caccialanza et al., 2018; Wells & MacDougall, 2020). This technique is commonly utilized for elderly patients and in palliative care, although there are no specific restrictions on its use in children (Pouvreau et al., 2017). However, HDC is not advised for certain groups, including patients with severe dehydration requiring large volumes and rapid infusion, individuals with coagulation disorders, edema, anasarca, circulatory failure, those on hemodialysis, and patients in emergency situations, among others (Lerner et al., 2020; Saganski & de Souza Freire, 2019; Sasson & Shvartzman, 2001). The administration of fluid via HDC and the evaluation of the infusion site should be conducted by a trained nurse. A needle catheter is inserted into the hypodermis, the deepest skin layer, with recommended sites including the anterior region of the thorax, deltoid, scapula, abdomen, or anterior and lateral thighs. The catheter, ideally small in

caliber, should be inserted at a 45-degree angle from the skinfold (Saganski & de Souza Freire, 2019; Walsh, 2005).

Systemic, gradual, and uniform absorption through subcutaneous tissue takes place via capillary diffusion, tissue perfusion, and hydrostatic and osmotic pressures. This process involves various blood capillaries and lymphatic vessels within the tissue and is contingent on the individual's blood circulation status. Capillary diffusion, characterized by the unimpeded movement of molecules—including water molecules and substances dissolved in body fluids—occurs in different directions, facilitating collisions between molecules (Saganski & de Souza Freire, 2019; Wells & MacDougall, 2020). Tissue perfusion, responsible for transporting nutrients and oxygen to diverse body tissues through blood flow, plays a vital role in this mechanism (Saganski & de Souza Freire, 2019).

2.9 Optimizing Fluid Administration: A Comprehensive Review of Hypodermoclysis and International Guidelines.

The international guidelines stipulate a subcutaneous administration limit of 1500 mL to 2000 mL within a 24-hour period at one site and up to 3000 mL across two different insertion sites (Saganski & de Souza Freire, 2019; Walsh, 2005). However, the National Cancer Institute in Brazil restricts simultaneous infusion to a maximum of 2 L (Saganski & de Souza Freire, 2019). The recommended infusion rate ranges from 20 mL to 80 mL per hour, considering the potential occurrence of edema and other adverse events (Saganski & de Souza Freire, 2019; Walsh, 2005). In alignment with the absorption mechanism mentioned earlier, only water-soluble and pH-neutral drugs are suitable for infusion, with a caution against hypertonic or hypotonic solutions lacking electrolytes to prevent potential harm and tissue damage. Fluids endorsed for this route include 0.9% saline (SF), 5% glycerol serum, Ringer's lactate, sodium chloride, and potassium

chloride solutions. For drug infusion, they should be in a liquid state and diluted 100% (1 mL of medication for 1 mL of diluent) using water for injection or 0.9% SF (Pranoy Barua & Bimal K Bhowmick, 2005; Saganski & de Souza Freire, 2019; Wells & MacDougall, 2020).

In contrast to alternative administration routes, hypodermoclysis (HDC) offers several advantages, including reduced pain, absence of limb immobility requirements, a low incidence of infection, enhanced convenience for patients, families, and healthcare teams due to its simplicity, cost-effectiveness, and feasibility. HDC requires only a simple puncture, minimizing the discomfort associated with repeated attempts and resulting in shorter infusion times, particularly in emergency room settings. Moreover, it can be administered either in a hospital setting by the nursing team or in the patient's home by a trained caregiver with minimal equipment and technical support. Given these benefits, HDC holds promise for use in dehydrated children (Saganski & de Souza Freire, 2019).

2.10 Summary

Chapter Two delves into the evolution and challenges surrounding subcutaneous infusion therapy in modern healthcare, emphasizing its growing significance in managing fluid administration for elderly and pediatric patients. The literature review highlights the advantages of subcutaneous infusion, such as simplicity, cost-effectiveness, and applicability across diverse healthcare settings, while also identifying barriers like limited professional knowledge and varied international guidelines. There is no previous literature or researches on this subject in Palestine.

Chapter Three

Methodology

Introduction

The importance of this research lies in its capacity to fill a crucial void in understanding and healthcare practices concerning elderly patients in North Palestinian hospitals. Given the distinctive challenges posed by an aging population, the study's discoveries may provide invaluable perspectives on the use of subcutaneous hydration as a viable alternative for administering fluids. Through an examination of nursing knowledge, attitudes, perceptions and obstacles, the study strives to furnish a comprehensive grasp of the elements that impact the acceptance of subcutaneous hydration. This chapter presents a detailed description of the research methodology: study design, setting, population, participant's eligibility criteria, study population, sampling, measurements, data collection, data analysis plan and ethical considerations

Study Design

This research used predominantly employ a quantitative research methodology, incorporating elements of a descriptive cross-sectional study. The aim is to elucidate and furnish information on the extent of understanding and application of subcutaneous fluid hydration in the elderly, without any intention to influence or regulate the participants.

Study Setting

In Palestine there is no a special care unit that are dedicated to management of critically ill elderly. Most geriatric patients that would need IV hydration would be placed in a regular medical surgical or intermediate unit. Therefore, the settings were chosen accordingly. Four hospitals were chosen in northern Palestine, notably the National Governmental Hospital and Rafidia Surgical Hospital in Nablus, Thabet Thabet Governmental Hospital in Tulkarm, and Jenin Governmental Hospital in Jenin. It exclusively targets doctors and nurses stationed in the medical surgical and intermediate units, with a dedicated focus on comprehending the knowledge, perceptions and attitudes of healthcare professionals engaged in the care of elderly patients grappling with hydration challenges

3.3.1 National Governmental Hospital, Nablus

The National Governmental Hospital, located in Nablus, serves as a major healthcare institution in northern Palestine. The hospital comprises two floors and includes several internal departments: the women's internal medicine department with 25 beds, the men's internal medicine department with 25 beds, and the intensive care unit, which has 11 beds.

3.3.2 Rafidia Surgical Hospital, Nablus:

Rafidia Surgical Hospital, located in Nablus, is renowned for its surgical expertise and comprehensive healthcare services. The hospital spans three floors and houses several key departments: the orthopedic department with 35 beds, the general surgery department with 75 beds, the maternity department with 10 beds, and the intensive care unit with 12 beds.

3.3.3 Thabet Thabet Governmental Hospital, Tulkarm

Thabet Thabet Governmental Hospital, located in Tulkarm, is a vital healthcare facility in northern Palestine, serving the medical needs of the local community. The hospital spans three floors and houses several important departments: the men's internal medicine department with 16 beds, the women's internal medicine department with 10 beds, the women's surgery department with 26 beds, and the intensive care unit with 8 beds.

3.3.4 Jenin Governmental Hospital, Jenin

Located in Jenin, Jenin Governmental Hospital is a prominent healthcare institution in northern Palestine, dedicated to providing comprehensive medical services to the population. The hospital spans three floors and includes several important departments: the orthopedic department with 25 beds, the general surgery department with 25 beds, the internal medicine department with 25 beds, and the intensive care unit with 9 beds.

3.4 Study Population and sampling

Healthcare professionals, including doctors, nurses, pharmacists, therapists, and nutritionists, employed in the Medical and Surgical departments of selected hospitals in northern Palestine, who met the inclusion criteria. Purposive sampling was employed, sample size was estimated 197 participants to be included in the study. Of these, 185 participants completed the questionnaire, with one disregarded due to incompleteness. 20 participants who had previously participated in the pilot study were excluded from the final analysis. Therefore, a total of 164 participants were included in the study, distributed as follows: 47 doctors, 99 nurses, 15 pharmacists, and 3 nutritionists. So, the actual response rate was 82% .

3.5 Sample size

The study used G*Power software version 3.1.7.9 to calculate the required sample size. Considering the total desired population of health care professional was estimated to be 400, a sample size of 197 health care professionals was determined Confidence Level of 95% and Margin of Error 5%. The calculations considered the desired alpha level (0.05), power (0.8), and effect size (0.15) to ensure the study has sufficient power to detect meaningful effects and draw reliable conclusions.

Inclusion Criteria

Participants who are qualified and who have worked in medical surgical units.

Exclusion Criteria

Non-health care professionals, those assigned to different units within the hospital, individuals who did not interact with elderly patients, those with less than six months of work experience, lacked proficiency in reading, speaking, and writing English, any health care professional who recently transferred to the surgery or internal medicine departments for a period not exceeding six months regardless of their experience in other departments, or any participant that didn’t meet inclusion criteria.

Study Variables

Dependent variables

Healthcare provider’s Knowledge and perception: These variable measures the level of understanding and awareness among healthcare provider regarding subcutaneous fluid administration in the context of elderly patient care.

Healthcare provider's Attitudes: This variable assesses the feelings, and beliefs of health care providers towards utilizing subcutaneous fluid administration for elderly patients

Independent variables:

Demographic Variables: These include characteristics such as (age, gender, level of education, years of experience, job title and previous experience or training with subcutaneous hydration)

Data Collection Procedure

The study underwent rigorous ethical review and approval by the IRB of the Arab American University. Permission was granted from the IRB the Arab American University. An approval from the Ministry of Health was also obtained prior to conducting the study in the hospitals. Permission was also obtained from all selected hospitals to solicit participants. Participants, exclusively chosen from the Medical-Surgical departments, were invited to join the study. Announcement notifications were sent to each hospital's employees informing them about the study and encouraging them to participate by filling out the online questionnaire via hospital email and Facebook. The participants received the survey and accessed it through their personal emails, and all communications were conducted in English. Comprehensive details of the study were disclosed to the participants to ensure transparency. Data collection employed modified and derived questionnaires tailored to the study's objectives. The questionnaire was conveniently administered electronically via a Google Documents site, facilitating ease of response submission by participants. The questionnaire was kept available online for participants for one month. The actual response rate was 82%, with 164 participants included in the final analysis.

Data Collection Tool

The instrument utilized in this study was a questionnaire designed to gather demographic information and assess knowledge regarding subcutaneous fluid hydration in elderly patients among healthcare professionals. The questionnaire was designed to be comprehensive yet concise, with clear and straightforward questions to ensure accurate data collection and analysis. Prior to distribution, the questionnaire underwent validation by experts in the field to ensure its

The questionnaire consists of three parts: Demographic Information, Knowledge Assessing Questions, and attitude assessing statements

Part 1: Demographic Information

This section of the questionnaire aimed to collect data regarding the participants' profession, gender, age, educational level, and years of experience in healthcare.

Part 2: Knowledge Assessing Questions

This section comprised of 14 questions aimed at assessing the participants' knowledge regarding subcutaneous fluid hydration in elderly patients. The questions covered various aspects such as indications, benefits, contraindications, fluid choice, infusion duration, infusion rate, site selection, complications, needle gauge range, and frequency of site checks.

Part 3: First section - Attitude assessing statements

The final part of the questionnaire contains 5 questions sought to gather the participants' opinions regarding subcutaneous fluid hydration in elderly patients. It included statements about the viability of subcutaneous hydration as an alternative to IV hydration, the need for formal training programs, the importance of increased training and inclusion of subcutaneous hydration in care protocols.

Second section included a question regarding factors influencing the decision for subcutaneous hydration, concerns or drawbacks regarding subcutaneous hydration, and limitations and obstacles of utilizing subcutaneous hydration.

Pilot study

The pilot study was instrumental in identifying potential obstacles encountered during data collection, while also assessing the clarity, applicability, and suitability of the questionnaires for participants. It aimed to gauge the time required to complete the questionnaires, initially estimated at 10-15 minutes, and solicited feedback on language, word choice, and questionnaire organization from participants. Adjustments were made based on this feedback to enhance questionnaire efficacy.

Conducted prior to the main study, the pilot study involved 20 participants for the pilot study. Nurses, doctors, pharmacists, and nutritionists working in the Medical and Surgical departments of selected hospitals. Data obtained from the pilot study facilitated the calculation of internal consistency reliability coefficients for the scales in English, vital for the study's integrity. Notably, participants involved in the pilot study were excluded from the actual data collection phase.

Data Statistical Analysis

Statistical Software SPSS 29 was used for data analysis. Descriptive statistics was used to measure (mean and standard deviation) for the variables. Inferential statistics was used to examine relationships between variables using independent t-test and one way ANOVA . Spearman correlation coefficients were used to examine the relationships between knowledge scores, attitudes, and perceptions. P-value of < 0.05 was considered for the significant relationships and the rejection of null hypotheses.

Ethical Considerations

The study presented in this thesis was approved by the Institutional Review Board (IRB) at AAUP. To respect the rights, dignity, and safety of the research participants, the researcher explained to the participants the purpose and content of the study, the duration, the research procedure, the confidentiality, the benefits, and the accompanying risks, as detailed on the first page of the study questionnaire. Data collection was conducted only for persons who agreed to participate voluntarily in the study. Participants were informed of their right to withdraw from the study at any time. The data was stored securely using encrypted digital storage, with access limited to the researcher only.

Chapter Four

Results

This chapter shows the descriptive and analytical results related to the current study about the knowledge, perception and attitudes of healthcare professionals towards subcutaneous fluid administration for elderly people. The descriptive results included the distribution of healthcare professionals' demographic data and their answers to questions and statements related to their knowledge and attitudes in terms of frequencies and percentages, as well as the description of the total knowledge and attitude scores in means and standard deviations (SD). On the other hand, the analytical results showed the significance of the relationships between study's independent and dependent variables, i.e., between healthcare professionals' demographic factors and their knowledge and attitude scores, using the suitable inferential statistics.

Part 1: Demographic data of the healthcare professionals

In Table 4.1 the demographic data of the healthcare professionals who participated in the study (n = 164) are distributed in frequencies and percentages and shows that the sample mainly consisted of nurses (60.4%) and doctors (28.7%), with more male than female participants (58.5% vs 41.5%). Also, they were mostly aged between 21 and 30 years old (56.7%) and 31 – 40 years old (29.9%). In addition, more than three quarters of the participants (78.7%) hold the bachelor's degree as their current educational level, and around one third of them (32.3%) have 1 – 5 years of experience in healthcare.

Table 4. 1: Distribution of demographic data of the healthcare professionals (n = 164)

Variable	Values	Frequency	Percentage
Profession	Doctor	47	28.7%
	Nurse	99	60.4%
	Pharmacist	15	9.1%
	Nutritionist	3	1.8%
Gender	Male	96	58.5%
	Female	68	41.5%
Age category	21 – 30 years old	93	56.7%
	31 – 40 years old	49	29.9%
	41 – 50 years old	13	7.9%
	51 – 60 years old	8	4.9%
	61 years an older	1	0.6%
Educational level	Diploma degree	10	6.1%
	Bachelor's degree	129	78.7%
	Master's degree	20	12.2%
	PhD degree	5	3.0%
Years of experience in healthcare	Less than 1 year	29	17.7%
	1 – 5 years	53	32.3%
	6 – 10 years	35	21.3%
	11 – 15 years	21	12.8%
	16 years or more	26	15.9%

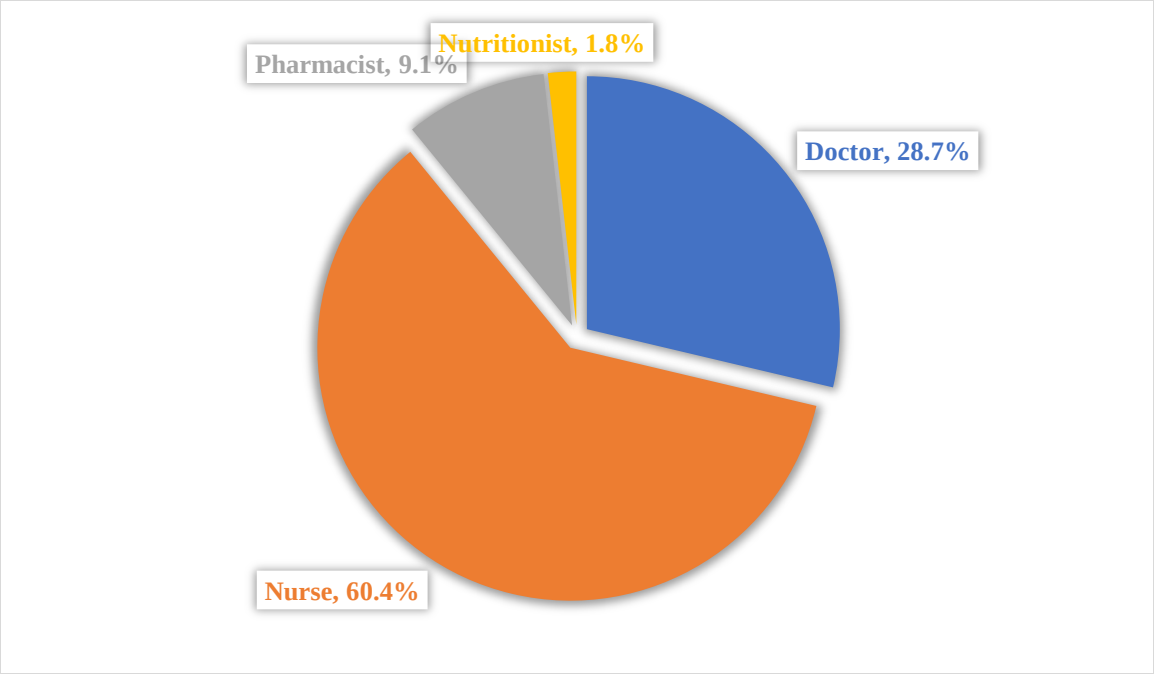


Figure 1: Distribution of participants' profession

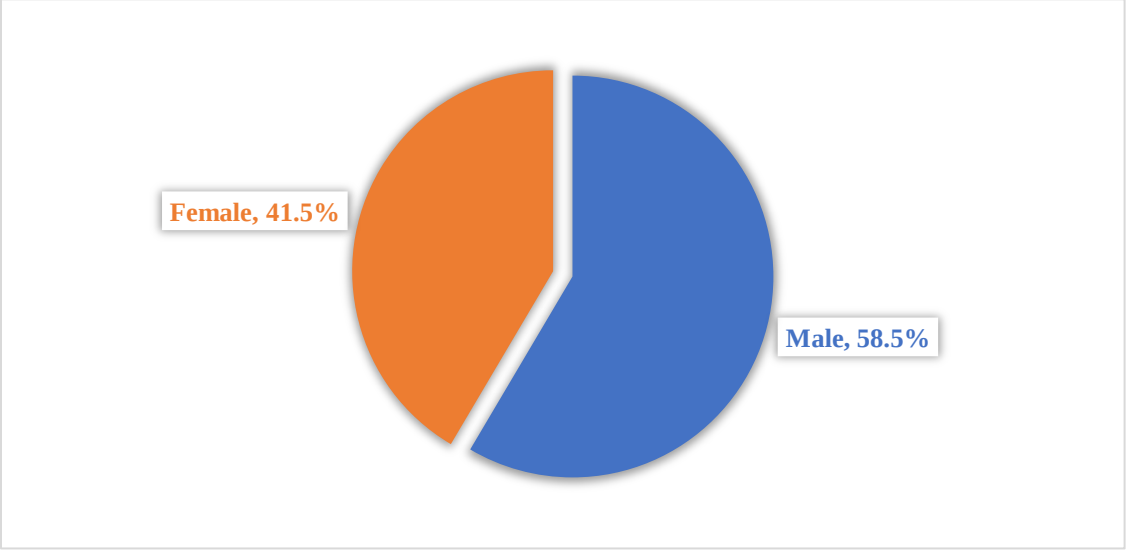


Figure 2: Distribution of participants' gender

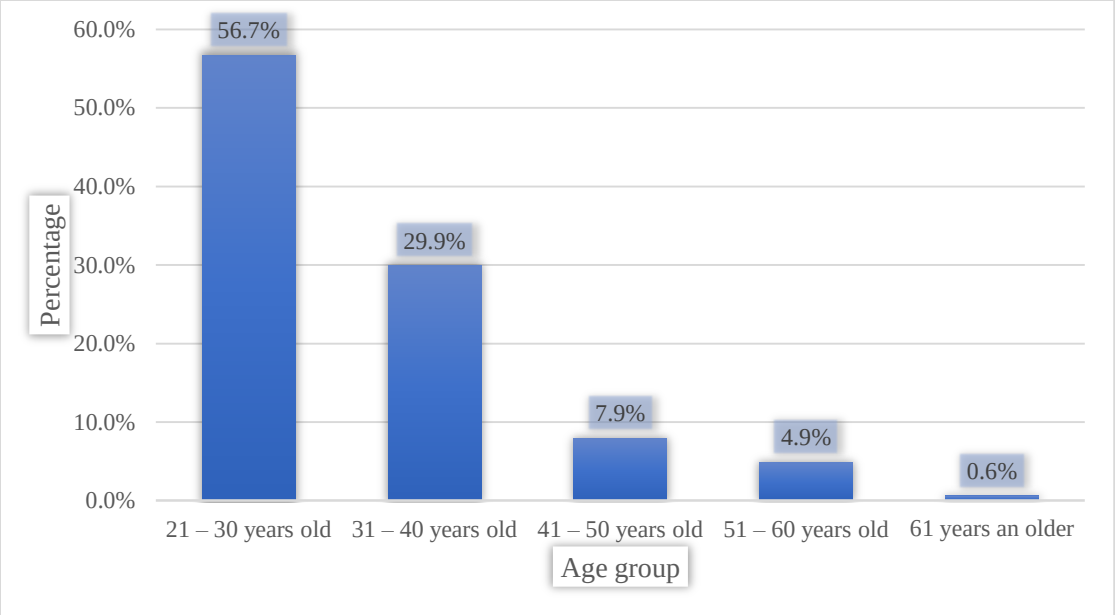


Figure 3: Distribution of participants' age groups

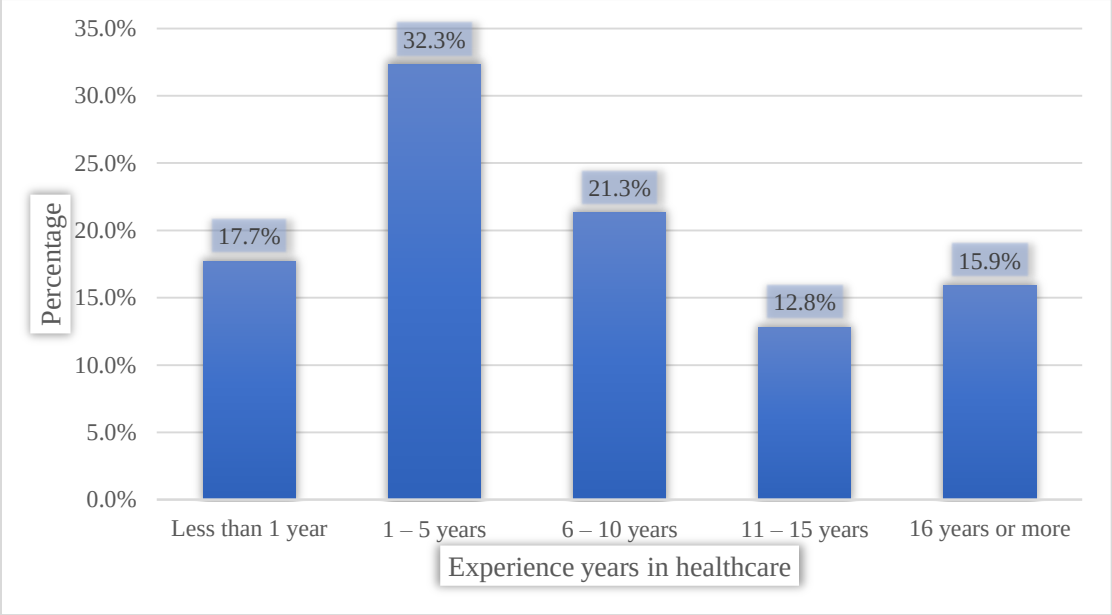


Figure 4: Distribution of participants' experience in healthcare

Part 2: Level of knowledge about subcutaneous fluid administration for elderly people among healthcare professionals

The following table (Table 4.2) distributes the answers of the healthcare professionals on the questions related to their level of knowledge about subcutaneous fluid administration for elderly people, as well as the correct answer for each question.

It shows that more than half of the participants correctly answered that fluids can be administered subcutaneously in elderly patients instead of intravenously (56.4%), while around one fourth of the participants (26.4%) correctly defined the medical terminology for subcutaneous fluid administration, which was hypodermoclysis, and the same appeared in the question related to the main indication for subcutaneous fluid administration among elderly patients, which was the condition on intolerance to oral intake due to cognitive impairment, dysphagia, a terminal illness or intractable vomiting (24.5%).

More than two thirds of the participants correctly answered the main benefit of subcutaneous fluid administration among elderly patients, which is being less likely to cause systemic complications (69.9%), while a larger percentage (84.6%) correctly chose the significant disadvantage of subcutaneous fluid administration, which is inability to use in emergency management of dehydration. The participants were mostly aware of the most common contraindication of using subcutaneous fluids that is related to hypovolemic shock (74.4%), while two thirds of them correctly chose the best fluid to administer for subcutaneous administration, which was normal saline (NS) 0.9% (66.7%).

In terms of maintenance, 69.8% of the participants correctly chose the range of 24 to 48 hours as the maximum length of subcutaneous hydration infusion in elderly patients, with an approximate percentage (68.1%) for choosing the correct standard recommendation for

subcutaneous fluid administration rate, which was 20 – 80 ml/hr. Also, more than three fourths of the participants correctly chose the abdomen as the preferred site for subcutaneous fluid administration, with around two thirds of the participants (65.8%) correctly choosing all of the mentioned complications for subcutaneous fluid administration, including all of local skin irritation, site bleeding and infections. More than half of the participants (55.5%) correctly chose the most suitable gauge range for needles used in subcutaneous fluid administration, which was between 22G and 25G, while 69.5% of the participants correctly chose the frequency of each 8 hours to check the insertion site. Lastly, 69.9% of the participants correctly approved that subcutaneous fluid administration can be safely and easily managed at home with nursing care arrangements.

Table 4. 2: Distribution of healthcare professionals' responses to questions about the level of knowledge about subcutaneous fluid administration for elderly people

Questions and answers	Frequency	Percentage*	Correct answer
1. Fluids can be administered subcutaneously in elderly patients instead of intravenously for hydration.			
A. True	92	56.4%	A
B. False	71	43.6%	
2. An Alternative name used to refer to subcutaneous infusion is:			
A. Hypodermoclysis	43	26.4%	A
B. Hypochemosis	7	4.3%	
C. Hpodermes	113	69.3%	
D. Hypophysis	0	0.0%	
3. Which of the following is an indication of subcutaneous hydration in elderly patients			
A. Patients who cannot tolerate oral intake due to cognitive impairment, dysphagia or a terminal illness or intractable vomiting.	40	24.5%	A
B. Doctors' preference	22	13.5%	

C. Failed IV access attempt	96	58.9%	
D. Patient's history of diabetes	5	3.1%	
4. Which one of the following is a benefit of using subcutaneous hydration in elderly patients			
A. More painful than peripheral IV	15	9.2%	C
B. Complicated and difficult insertion technique	25	15.3%	
C. Less likely causes systemic complications	114	69.9%	
D. Expensive	9	5.5%	
5. A significant disadvantage of subcutaneous fluid administration in elderly patients is:			
A. Simple insertion technique	12	7.4%	D
B. Low maintenance	7	4.3%	
C. Low cost	6	3.7%	
D. Can not be used in emergency management of dehydration	137	84.6%	
6. A contraindication for administering subcutaneous fluids is:			
A. Hypovolemic shock	122	74.4%	A
B. Minor dehydration	20	12.2%	
C. Patient's preference	15	9.1%	
D. Patient is 65 years old	7	4.3%	
7. What is the best fluid choice for SQ fluid administration?			
A. NS (normal saline) 0.9%	108	66.7%	A
B. NS (normal saline) 3%	22	13.6%	
C. Dextrose 5%	7	4.3%	
D. None of the above	25	15.4%	
8. The maximum Length of Subcutaneous hydration infusion in elderly patients is:			
A. 24-28 hours	113	69.8%	A
B. 1 -2 weeks	37	22.8%	
C. 2 - 4 weeks	10	6.2%	
D. 1 – 2 months	2	1.2%	

9. The standard recommendation on Substances fluid infusion is:			
A. 200 ml/hr	31	19.4%	B
B. 20-80 ml/hr	109	68.1%	
C. 250 ml/hr	10	6.3%	
D. 500 ml/hr	10	6.3%	
10. The best site for subcutaneous fluid infusion is:			
A. Abdomen	127	77.4%	A
B. Ankles	7	4.3%	
C. Elbows	20	12.2%	
D. Knees	10	6.1%	
11. The most common complications of subcutaneous fluid are:			
A. Local skin irritation	31	19.3%	D
B. Site bleeding	16	9.9%	
C. Infection	8	5.0%	
D. All of above	106	65.8%	
12. A commonly recommended gauge range for needle used in subcutaneous fluid therapy is:			
A. 22 – 25 G	91	55.5%	A
B. 18 G	35	21.3%	
C. 14 G	20	12.2%	
D. 16 G	18	11.0%	
13. How often Insertion site must be checked			
A. At least every 8 hours	114	69.5%	A
B. Daily	45	27.4%	
C. Weekly	5	3.0%	
D. Every 10 days	0	0.0%	

14. Subcutaneous self-administered fluid can be safely and easily managed at home with home nursing care arrangements			
A. True	114	69.9%	A
B. False	49	30.1%	

* = Valid percentages are shown due to presence of missing answers in some questions

The level of knowledge was calculated by summing the number of correct answers for each participant, and then converting it to a score out of 100%. Table 4.3 shows that the mean number of correct answers for each participant was 8.720 ± 2.746 out of 14 questions, ranging from 2 to 13 questions, and when converted to 100%, the mean score was 62.282% ± 19.614%, ranging from 14.29% to 92.86%, which indicates that the overall score of the participants regarding subcutaneous fluid administration was satisfying. According to the cut points shown in Table 2.3, which shows that around one half of the participants had a low level of knowledge, compared to more than one third of them who had a moderate level of knowledge, regarding subcutaneous fluid administration, taking into account that non-answered questions were considered a wrong answer.

Table 4. 3: Descriptive statistics of the knowledge scores about subcutaneous fluid administration among the participants

Knowledge score	Mean	SD	Minimum	Maximum
Out of 14 questions	8.720	2.746	2	13
Out of 100% score	62.282	19.614	14.29	92.86

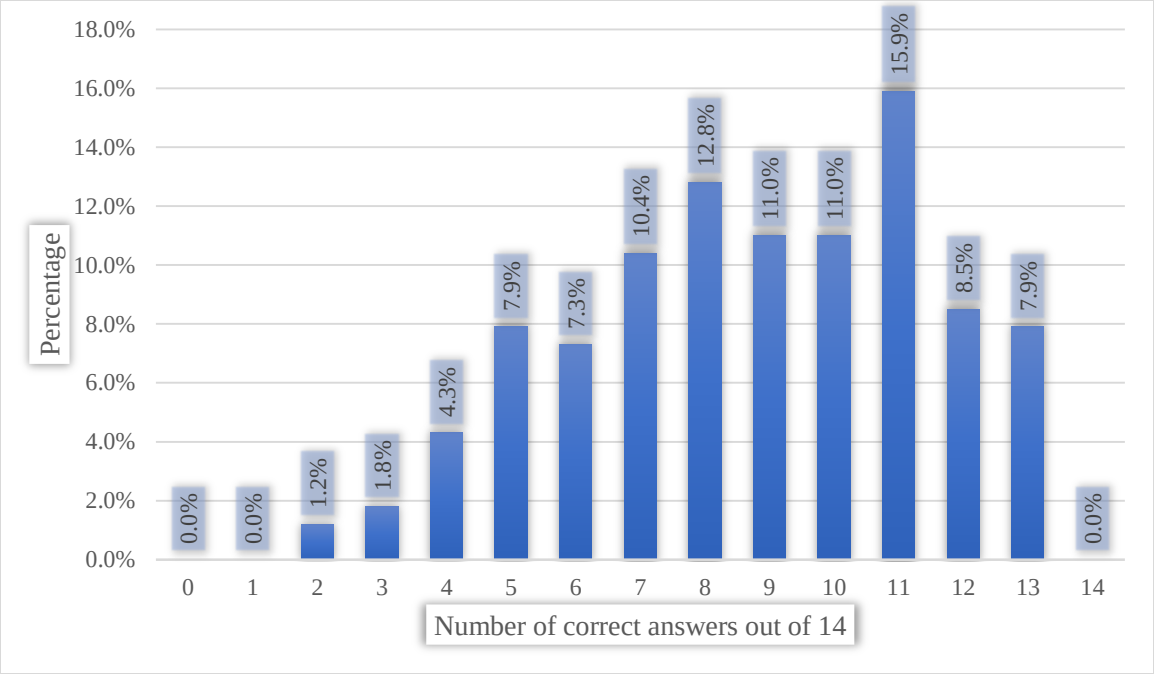


Figure 5: Distribution of number of correct answers out of 14

Table 4. 4: Distribution of classifications of knowledge level regarding subcutaneous fluid administration in elderly patients among healthcare professionals

Knowledge classification	Classification range	Frequency	Percentage
Low level of knowledge	Score < 60%	75	45.7%
Moderate level of knowledge	Score = 60% - <80%	62	37.8%
High level of knowledge	Score = 80% and above	27	16.5%

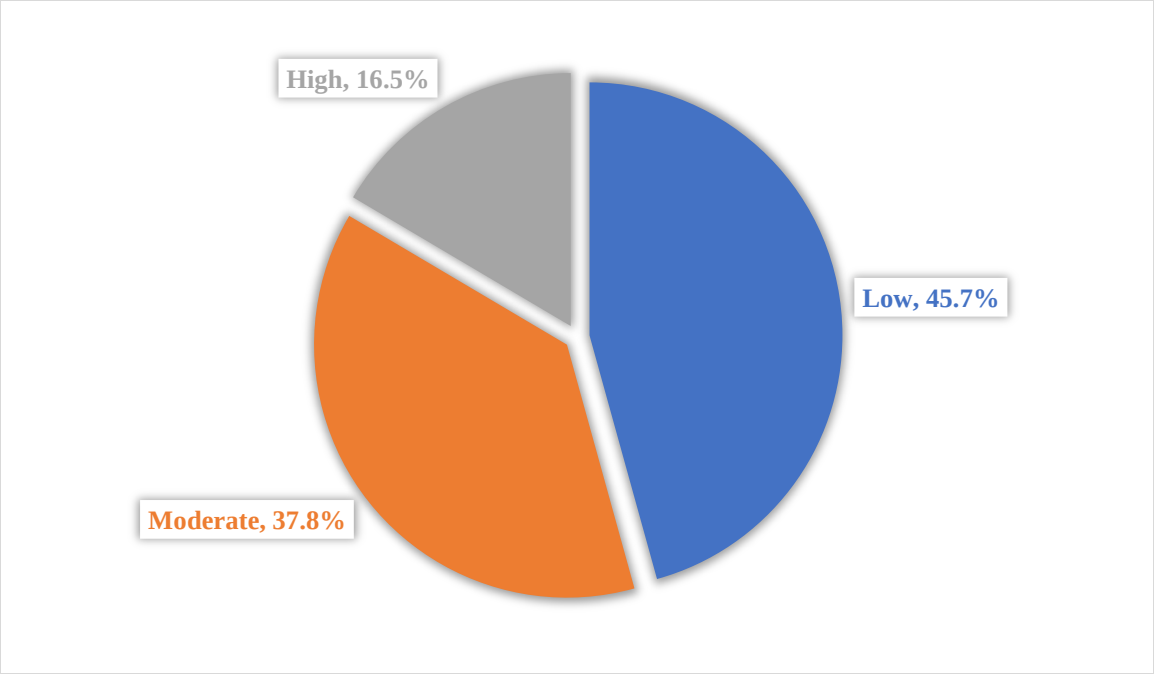


Figure 6: Distribution of knowledge classification

Part 3: Attitude of healthcare professionals towards subcutaneous fluid administration in elderly patients

In Table 4.5, the frequencies and percentages of the agreement levels towards statements related to healthcare professionals' attitude of subcutaneous fluid administration in elderly patients are shown. It shows that the highest agreement was in terms of the need for formal training programs among the healthcare professionals, especially nurses and doctors (mean = 4.35 out of 5), where 34.8% of them agree, and 51.8% strongly agree, on this statement. Following this, the healthcare professionals highly agreed on the necessity of increased training on this method among the healthcare professionals (mean = 4.05 out of 5), where 43.3% agreed and a similar percentage strongly agreed.

The third highest statement with agreement was related to the idea of including subcutaneous fluid administration in elderly patients as an option of care protocol (mean = 4.05

out of 5), where 43.3% agreed and 33.5% strongly agreed. Also, a moderately high agreement was found among healthcare professionals regarding the consideration of patient's preferences when deciding on hydration methods among elderly patients (mean = 3.93 out of 5), where 61.6% agreed and 18.3% strongly agreed. Lastly, a moderately high agreement was also found in terms of the viability of subcutaneous fluid administration option in elderly patients as an alternative to intravenous (IV) hydration (mean = 3.78 out of 5), where 42.7% agreed and 24.4% strongly agreed.

Table 4. 5: Distribution of healthcare professionals' agreement levels on statements related to their attitude towards subcutaneous fluid administration in elderly patients

Statements	Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Mean (of 5)
	F	%	F	%	F	%	F	%	F	%	
1. Subcutaneous fluid hydration is a viable option in elderly Patients as an alternative method to IV hydration	3	1.8%	16	9.8%	35	21.3%	70	42.7%	40	24.4%	3.78
2. There is a need for formal training programs on subcutaneous hydration in elderly patients for healthcare professionals - Doctors and Nurses	0	0.0%	5	3.0%	17	10.4%	57	34.8%	85	51.8%	4.35
3. Increased training on subcutaneous hydration in elderly Patients is essential for healthcare professionals	1	0.6%	5	3.0%	14	8.5%	72	43.9%	72	43.9%	4.27
4. Subcutaneous hydration should be included as an option of the care protocol for elderly patients	0	0.0%	8	4.9%	30	18.3%	71	43.3%	55	33.5%	4.05
5. Patients' preferences should be considered when deciding on hydration methods in elderly Patients	0	0.0%	9	5.5%	24	14.6%	101	61.6%	30	18.3%	3.93

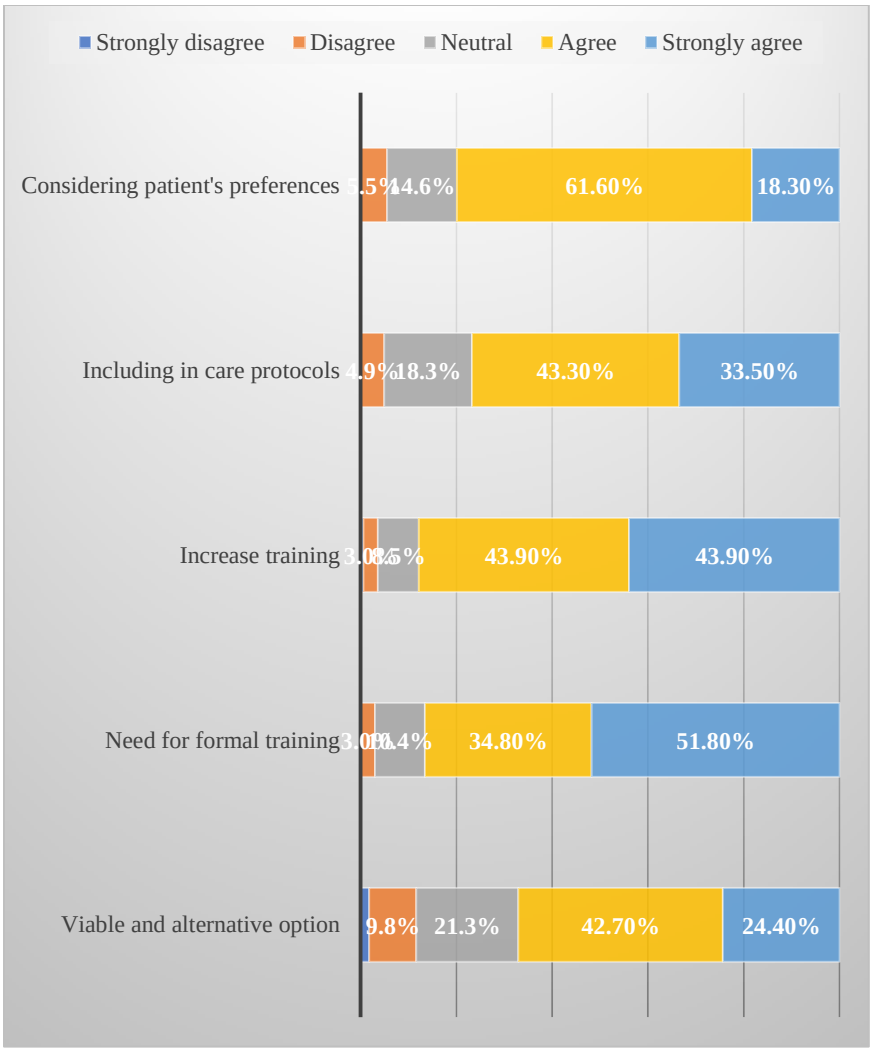


Figure 7: Attitude towards subcutaneous fluid administration in elderly patients among healthcare professionals

The score of attitudes towards subcutaneous fluid administration among healthcare professionals was calculated by summing the scores of agreement levels towards individual statements for each participant, and then converting the summation to a score out of 5, which have a mean score of 4.078 ± 0.619 out of 5, ranging from 2 to 5 out of 5. The scores were then converted to a score out of 100%, which resulted in a mean score of 81.56% ± 12.371%, ranging from 40% to 100%, with higher scores indicating a more positive attitude towards subcutaneous fluid administration in elderly patients (Table 4.6).

Table 4. 6: Descriptive statistics of attitude scores towards subcutaneous fluid administration in elderly patients

Attitude score	Mean	SD	Minimum	Maximum
Out of 5 (Likert scale level)	4.078	0.619	2	5
Out of 100% score	81.561	12.371	40	100

The scores of attitudes were then classified to poor, acceptable and good levels, as shown in Table 4.7, which shows that around two thirds of the healthcare professionals have a good level of attitude, compared to 29.3% with an acceptable level of attitude, towards subcutaneous fluid administration in elderly patients.

Table 4. 7: Distribution of attitude classifications towards subcutaneous fluid administration in elderly people among healthcare professionals

Attitude classification	Classification range	Frequency	Percentage
Poor level of attitude	Score < 60%	5	3.0%
Acceptable level of attitude	Score = 60% - <80%	48	29.3%
Good level of attitude	Score = 80% and above	111	67.7%

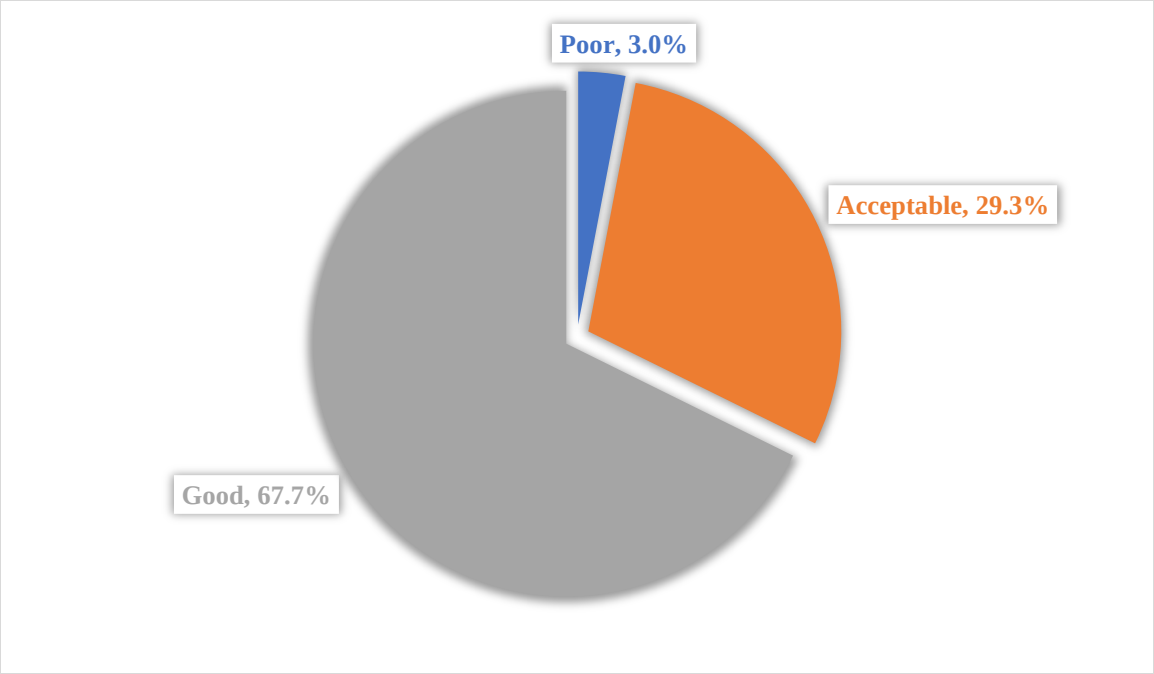


Figure 8: Distribution of Attitude classifications

The healthcare professionals who participated in the study were asked to choose the most commonly related limitation and obstacle of utilizing subcutaneous fluid administration in elderly patients, as shown in Table 3.4, which shows that more than half of the nurses (51.8%) choose the lack of training as the main limitation, followed by limited information (21.3%), organizational policies (11.0%), lack of home nursing care services (5.5%) and patient's preferences (4.9%).

Table 4. 8: Distribution of the limitations and obstacles of utilizing subcutaneous fluid administration in elderly patients according to healthcare professionals

Question	Options	Frequency	Percentage
What are the limitations and obstacles of utilizing subcutaneous hydration in elderly patients?	Lack of training	85	51.8%
	Organizational policy	18	11.0%
	Limited information	35	21.3%
	Lack of home care nursing services	9	5.5%
	Patient's preference	8	4.9%
	Others	9	5.5%

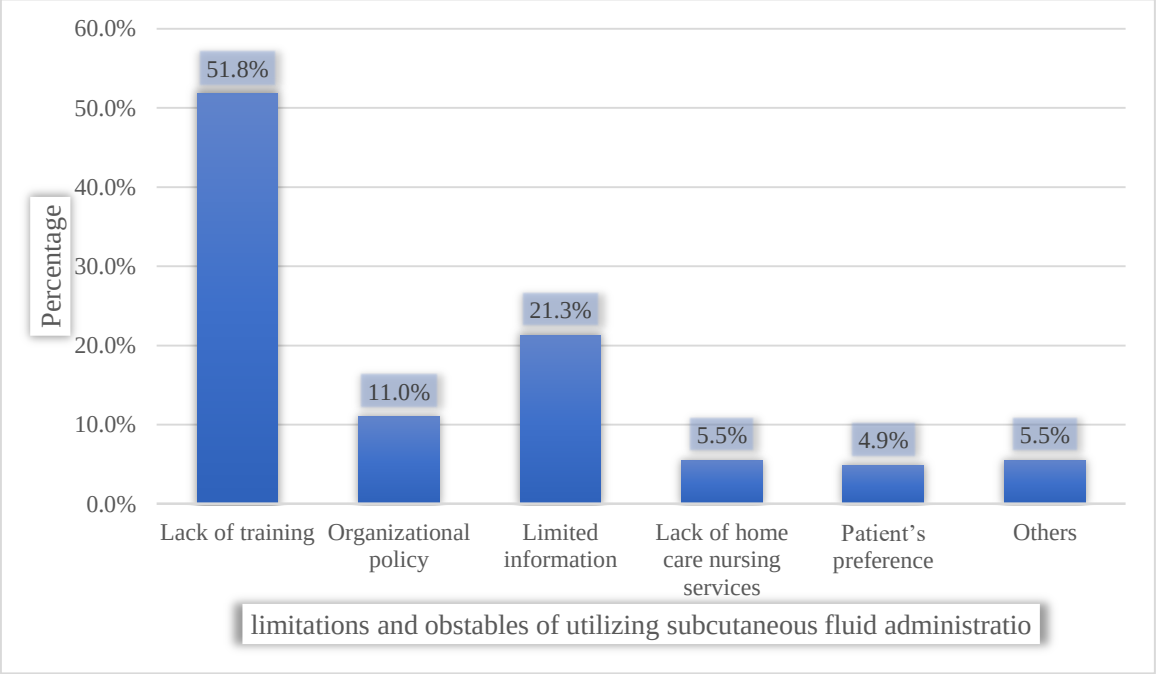


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Figure 9: Distribution of limitations and obstacles of utilizing subcutaneous fluid administration in elderly patients

Part 4: Differences in knowledge and attitudes of healthcare professionals towards subcutaneous fluid administration in elderly people according to their demographic factors

The mean differences in knowledge and attitude scores are shown in Table 4.1 and Table 4.3, respectively, using the suitable inferential statistics, in which independent samples t-test was used to investigate the differences in knowledge and attitude scores according to the healthcare professionals' gender, while one-way ANOVA was used to investigate the differences in knowledge and attitudes according to healthcare professionals' profession, age category, educational level and years of experience in healthcare. On the other hand, the differences in frequencies and percentages of knowledge and attitude classifications according to the demographic factors of the healthcare professionals were testes using chi-square test, as shown in Table 4.2 and Table 4.4, because both of the independent and dependent variables in this case are categorical.

Table 4.9 shows that the profession of the participants significantly affected the level of knowledge about subcutaneous fluid administration in elderly patients (p-value = 0.002), where doctors (mean = 69.301 ± 17.867) and allied health professionals (mean = 67.460 ± 17.362) had higher knowledge scores than nurses (mean = 58.009 ± 19.767), which also appears in the significance of the differences in classifications of knowledge according to the profession of participants (p-value = 0.011), where 53.2% and 21.3% of the doctors, and 38.9% and 22.2% of the allied health professionals, showed moderate and high knowledge levels, respectively, compared to 30.3% and 13.1% among nurses, respectively, as shown in Table 4.9.

On the other hand, none of the rest of the demographic factors of healthcare professionals showed a significant relationship with either scores or classifications of knowledge about subcutaneous fluid administration in elderly patients (p-value > 0.05).

Table 4. 9: Mean differences in knowledge scores (out of 100%) according to the demographic factors of healthcare professionals

Factor	Values	Mean	SD	Test value	p-value
Profession*	Doctor	69.301	17.867		
	Nurse	58.009	19.767	6.381	0.002
	Allied	67.460	17.362		
Gender	Male	61.384	20.949	- 0.696	0.488
	Female	63.550	17.632		
Age category**	18 – 30 years old	63.210	20.064		
	31 – 40 years old	59.184	18.558	0.969	0.382
	41 years and older	65.260	19.997		
Educational	Diploma degree	54.286	17.561		
level***	Bachelor's degree	63.012	19.672	0.930	0.397
	Higher educations	61.714	20.085		
Years of experience	Less than 1 year	71.182	19.975		
in healthcare	1 – 5 years	60.377	18.614		
	6 – 10 years	61.429	16.903	1.901	0.113
	11 – 15 years	59.864	20.883		
	16 years or more	59.341	22.110		

* In profession, pharmacists and nutritionists were combined under “allied” category. ** = The participants who are 41 years of age or older were combined under the category of 41 years and older. *** = Master’s degree and PhD were combined under the category of “higher educations".

Table 4. 10: Differences in knowledge classifications of subcutaneous fluid administration in elderly patients according to the healthcare professionals’ demographic factors

Factor	Values	Low		Moderate		High		X^2	p-value
		F	%	F	%	F	%		
Profession*	Doctor	12	25.5%	25	53.2%	10	21.3%		
	Nurse	56	56.6%	30	30.3%	13	13.1%	13.033	0.011
	Allied	7	38.9%	7	38.9%	4	22.2%		
Gender	Male	42	43.8%	39	40.6%	15	15.6%	0.785	0.675
	Female	33	48.5%	23	33.8%	12	17.6%		
Age category**	21 – 30 years old	40	43.0%	37	39.8%	16	17.2%		
	31 – 40 years old	26	53.1%	17	34.7%	6	12.2%	2.157	0.707
	41 years and older	9	40.9%	8	36.4%	5	22.7%		
Educational	Diploma degree	8	80.0%	1	10.0%	1	10.0%		
level***	Bachelor’s degree	54	41.9%	52	40.3%	23	17.8%	3.189	0.186
	Higher educations	13	52.0%	9	36.0%	3	12.0%		
Years of	Less than 1 year	8	27.6%	11	37.9%	10	34.5%		
experience in	1 – 5 years	25	47.2%	23	43.4%	5	9.4%		
healthcare	6 – 10 years	18	51.4%	14	40.0%	3	8.6%	14.741	0.064
	11 – 15 years	12	57.1%	4	19.0%	5	23.8%		
	16 years or more	12	46.2%	10	38.5%	4	15.4%		

* In profession, pharmacists and nutritionists were combined under “allied” category. ** = The participants who are 41 years of age or older were combined under the category of 41 years and older. *** = Master’s degree and PhD were combined under the category of “higher educations".

Table 4.11 investigates the differences in attitude scores according to the healthcare professionals’ demographic factors, which showed that the educational level nearly showed a no significant relationship with attitude scores (p-value = 0.088), where higher educations are associated with more positive attitude scores, but this relationship was more clear when the educational levels were compared with the classifications of attitude (p-value = 0.022), where 36.0% and 64.0% of the healthcare professionals with higher educations showed acceptable and good attitude levels, respectively, compared to 27.9% and 69.8%, respectively, among bachelor’s degree holders, and 30.0% and 50.0%, respectively, among diploma degree holders, as shown in Table 4.11.

On the other hand, none of the rest of the demographic factors of healthcare professionals showed a significant relationship with either scores or classifications of attitude towards subcutaneous fluid administration in elderly patients (p-value > 0.05).

Table 4. 11: Mean differences in attitude scores (out of 100%) according to the demographic factors of healthcare professionals

Factor	Values	Mean	SD	Test value	p-value
Profession*	Doctor	82.298	14.099		
	Nurse	80.566	12.149	1.147	0.320
	Allied	85.111	7.615		
Gender	Male	81.042	13.289	- 0.638	0.525
	Female	82.294	10.999		
Age category**	21 – 30 years old	80.903	12.692		
	31 – 40 years old	80.980	11.241	1.386	0.253
	41 years and older	85.636	13.160		
Educational level***	Diploma degree	74.000	12.111		
	Bachelor's degree	81.643	12.305	2.46	0.088
	Higher educations	84.160	12.082		
Years of experience in healthcare	Less than 1 year	85.517	9.880		
	1 – 5 years	79.472	13.968		
	6 – 10 years	80.000	11.272	2.306	0.061
	11 – 15 years	78.857	11.253		
	16 years or more	85.692	12.402		

* In profession, pharmacists and nutritionists were combined under "allied" category. ** = The participants who are 41 years of age or older were combined under the

category of 41 years and older. *** = Master's degree and PhD were combined under the category of "higher educations".

Table 4. 12: Differences in attitude classifications towards subcutaneous fluid administration in elderly patients according to the healthcare professionals' demographic factors

Factor	Values	Poor		Acceptable		Good		X^2	p-value
		F	%	F	%	F	%		
Profession*	Doctor	2	4.3%	13	27.7%	32	68.1%		
	Nurse	3	3.0%	32	32.3%	64	64.6%	2.895	0.576
	Allied	0	0.0%	3	16.7%	15	83.3%		
Gender	Male	5	5.2%	29	30.2%	62	64.6%	3.940	0.139
	Female	0	0.0%	19	27.9%	49	72.1%		
Age category**	21 – 30 years old	3	3.2%	31	33.3%	59	63.4%		
	31 – 40 years old	1	2.0%	15	30.6%	33	67.3%	5.332	0.255
	41 years and older	1	4.5%	2	9.1%	19	86.4%		
Educational	Diploma degree	2	20.0%	3	30.0%	5	50.0%		
level***	Bachelor's degree	3	2.3%	36	27.9%	90	69.8%	11.474	0.022
	Higher educations	0	0.0%	9	36.0%	16	64.0%		
Years of	Less than 1 year	0	0.0%	7	24.1%	22	75.9%		
experience in	1 – 5 years	3	5.7%	19	35.8%	31	58.5%		
healthcare	6 – 10 years	1	2.9%	10	28.6%	24	68.6%	10.335	0.242
	11 – 15 years	0	0.0%	9	42.9%	12	57.1%		
	16 years or more	1	3.8%	3	11.5%	22	84.6%		

* In profession, pharmacists and nutritionists were combined under "allied" category. ** = The participants who are 41 years of age or older were combined under the

category of 41 years and older. *** = Master's degree and PhD were combined under the category of "higher educations".

Lastly, the correlation between healthcare professionals' knowledge and attitude scores towards subcutaneous fluid administration in elderly patients was tested and shown in Table 4.13 using Pearson Correlation test, which states that no significant correlation was found between the knowledge and attitude scores (r = 0.130, p-value = 0.097).

Table 4. 13: Correlation between knowledge and attitude towards subcutaneous fluid administration in elderly patients among healthcare professionals

Domain	Correlation with knowledge		Correlation with attitude	
	Coefficient	p-value	Coefficient	p-value
Knowledge scores			0.130	0.097
Attitude scores	0.130	0.097		

Conclusion

The study recruited a total of 164 healthcare professionals, mostly nurses (60.4%), males (58.5%), aged 21 – 30 years old (56.7%), bachelor's degree holders (78.7%) and having 1 – 5 years of experience. Their mean knowledge scores about subcutaneous fluid administration in elderly patients was 62.282% ± 19.614%, with 45.7% and 37.8% having low and moderate knowledge levels, respectively, compared to a mean attitude score of 81.561% ± 12.371%, with 29.3% and 67.7% having acceptable and good attitude levels, respectively. Lacking training was rated the most common limitation and obstacle of subcutaneous fluid administration utilization.

Doctors and allied healthcare professionals significantly showed higher mean scores of knowledges (p-value = 0.002), as well as more high knowledge levels (p-value = 0.011), compared to nurses, while participants with higher educational levels showed higher percentage of good attitude levels (p-value = 0.022). No significant correlation was found between healthcare professionals' knowledge and attitude scores (p-value = 0.097).

Chapter Five

Discussion

This chapter is dedicated to discussing the findings of the current thesis, where the researcher provides a critical overview of the most highlighted descriptive and analytical results from the researcher's point of view, in addition to the comparison between them and the previous studies.

In terms of sampling, the current study recruited a total of 164 healthcare professionals that are found to be representative to the overall proportional distribution of healthcare professions in Palestine, where most of them are nurses (60.4%), and this percentage is slightly higher than the proportion of nurses worldwide, in which it was found that around 50% of the healthcare workforce consists of nurses (Singh, 2021). On the other hand, most of the sampled healthcare workers are between under 40 years of old (86.6%), which indicates a much lower median age than what is found in USA related to the age distribution of healthcare workers, where the median age was found to be 52 years old (Smiley et al., 2018) which can be related to less interest in voluntary participation in clinical research among older healthcare professionals.

Multiple-choice questions (MCQs) are reliable, valid, and cost-effective for assessing medical knowledge across various domains (Abdel-Hameed et al., 2005), and are also effective in different settings and suitable for statistical analysis (Suryadevara & Bano, 2018). Therefore, MCQs were preferred to be used in the current study to assess the level of knowledge among the sampled healthcare professionals.

Focusing on specific knowledge questions, it was found that near half of the HCPs did not have the previous knowledge about the possibility of subcutaneous fluid administration for elderly people (43.5%), with only 26.4% accurately identifying its medical terminology (hypodermoclysis). This indicates the lack of the basis of knowledge regarding hypodermoclysis among the Palestinian HCPs, which is a point that worth focusing on, and the researcher recommends increasing the awareness about it, as well as including it in the healthcare curricula. On the other hand, the sampled HCPs tended to have the initial knowledge about the probability of using this method for fluid administration, and therefore, higher accurate answers were found in the questions following them, which can be interpreted using predicting the correct answers based on what they expect this method would be. For example, 69.9% of the HCPs correctly answered the benefit of using hypodermoclysis regarding the less incidence of systemic complications, with 84.9% correctly answering the main disadvantage of this method, which was the inability to use it in emergency situations of hydration management. This indicates that the knowledge about hypodermoclysis can be acquired among HCPs in Palestine using simple educational and demonstrational methods.

Another advantage that may be used in this section of questionnaire is related to what E. Alexandrou (2014) has mentioned regarding the main disadvantage of conventional intravenous route among elderly people, which is related to the physical and psychological trauma among the patients related to multiple trials of venipuncture, which gives an additional advantage to hypodermoclysis.

The previous recommendation is supported by the finding that most of the sampled HCPs agree (34.8%) and strongly agree (51.8%) about the necessity of providing formal

education and training regarding this topic, with approximate agreement level (43.9% agree and strongly agree) regarding the need for increased training. The overall attitude of HCPs regarding hypodermoclysis is highly positive, with a mean score of 81.561%, and 67.7% of HCPs having an attitude score of 80% and higher. This can also reflect the preparedness of HCPs in Palestine to acquire more knowledge about this topic of dehydration management among a challenging type of patients.

This was also parallel with a finding in the current study, where 51.8% of the HCPs chose lack of training as the most common limitation and obstacle to implement hypodermoclysis. It is worth mentioning the comparison of the first use of hypodermoclysis in 1860s and the start of using it Western countries, but is lacked in Palestine. This is also challenged by the findings of Cabañero-Martínez et al. (2019), who stated the lack of internationally unified protocols for the safe administration of subcutaneous fluid, both among elderly and pediatric patients. This calls for the need to conduct further studies to investigate its practicality and the limitations and challenges that HCPs of concern face when implementing hypodermoclysis.

Previous studies, such as the integrative review by N. S. Gomes et al. (2017), highlight the scarcity of research on hypodermoclysis. Their review identified only eight eligible articles on the topic, with 25% being literature reviews and 62.5% employing a quantitative approach. Despite hypodermoclysis being an established method for fluid administration, its use remains limited. This underscores the need for further research, both in Palestine and internationally, as recommended by the current study.

The analytical results showed some interesting results, where the lowest mean knowledge score was found among nurses (58.009%, which can be considered

unsatisfactory), compared to doctors and allied health professionals, which is an alarming finding, and indicates the need to focus more on nursing continuous education regarding this topic, because nurses are the frontline and the most who spend time with patients. This point is crucial to highlight, as none of the other factors showed a significant relationship with the differences in mean knowledge scores or the percentages of knowledge classifications (p-value > 0.05). This highlights the need to educate nurses more about hypodermoclysis, despite their gender, age category, educational degree or years of experience.

In terms of differences in attitude levels, the analytical results showed significantly lower percentage of good attitude classification among diploma degree HCPs (50%), which indicates that acquiring more professional and academic degree is associated with higher attitude regarding hypodermoclysis. On the other hand, none of the rest of factors significantly impacted level of attitude, which can be related to the finding that the overall attitude level was high.

To focus on the importance of clinical training and practicing workshops regarding hypodermoclysis, a quasi-experimental study was conducted on a sample of 22 undergraduate nursing and medical students in Brazil, and used a valid tool to assess the level of knowledge before and after the implementation of educational intervention. The findings found a significant increase by 75% in the overall knowledge scores (p-value < 0.05), both in the theoretical and practical sides of knowledge. The results also found that the significant increases were noticed in domains of self-assessment and ability to explain (mean scores increased from 0.9 to 5.9), which is also an advantage of the multiple-choice type of questions to assess level of knowledge, as well as in the domain of hypodermoclysis

performance (1.9 to 5.0). It is worth noting that problematization methodology of education was used in the mentioned study, which is specific and showed positive impact (Coutinho et al., 2024).

The limitation related to lack of training and the lack of clear policies regarding hypodermoclysis is shared across the literature. This is parallel to the findings of the qualitative study of Cabañero-Martínez et al. (2016), who stated that discussing the educational needs was the least part of the focus group. Also, they stated that it is difficult to develop and disseminate related guidelines in this context.

Recommendations

Based on the findings of the current study and their discussion, the following recommendations are proposed, and are also supported previous literature:

1. **Enhance Educational Programs**: Develop comprehensive educational programs focused on hypodermoclysis. These should include practical workshops, seminars, and online courses. Ensuring that educational materials are evidence-based and cover both the theoretical and practical aspects will help in improving the knowledge and skills of healthcare professionals.

2. **Utilize Technology for Ongoing Education**: Implement and distribute educational technologies such as mobile apps, e-learning modules, and pocket guides. These tools can provide ongoing support, enhance knowledge retention, and offer quick access to essential information about hypodermoclysis.

3. **Address Misconceptions Through Education**: Conduct targeted educational interventions to address any biases or misconceptions about hypodermoclysis. Focus on

educating healthcare professionals about the benefits, safety, and efficacy of hypodermoclysis to improve its acceptance and usage.

4. **Develop Validated Assessment Tools**: Create a validated questionnaire specifically designed to measure healthcare professionals' knowledge of hypodermoclysis. Ensure the questionnaire covers essential areas such as indications, techniques, potential complications, and management strategies. Test the questionnaire for reliability and validity to ensure its effectiveness.

5. **Promote Research and Evidence-Based Practice**: Encourage further research on hypodermoclysis both locally in Palestine and internationally. Highlight the need for studies that explore the use, advantages, and limitations of hypodermoclysis in various healthcare settings to build a robust evidence base.

6. **Standardize Protocols and Training**: Develop and disseminate clear protocols and guidelines for hypodermoclysis. Ensure that these protocols are incorporated into the training programs for healthcare professionals to standardize the practice and improve patient outcomes.

7. **Foster Collaborative Learning Environments**: Create opportunities for healthcare professionals to share their experiences and learn from each other. Collaborative learning environments can help in disseminating best practices and innovations in hypodermoclysis.

8. **Engage Stakeholders**: Involve key stakeholders such as healthcare institutions, professional bodies, and policymakers in promoting and supporting the use of hypodermoclysis. Their engagement can facilitate the adoption of best practices and ensure the sustainability of educational and training programs.

Limitations

The study was limited by several points, including:

1. **Sample Demographics**: The study's findings may not be entirely generalizable to all healthcare professionals in Palestine due to the predominant inclusion of younger professionals (86.6% under 40 years), which may differ from the age distribution seen in other regions like the USA, where the median age of healthcare professionals is higher. This demographic skew may influence the knowledge and attitudes measured, as younger professionals might have different educational backgrounds and clinical experiences compared to their older counterparts.

2. **Educational and Gender Distribution**: The distribution of educational levels and gender among the participants also limits the generalizability of the findings. The sample included a high percentage of bachelor's degree holders (78.7%) and a lower proportion of female participants (41.5%) compared to global averages. These factors could affect the overall knowledge and attitudes towards subcutaneous fluid administration, as different educational backgrounds and gender perspectives might influence clinical practices and learning preferences.

3. **Regional Variations**: The study's context is specific to the Palestinian healthcare system, which might have unique challenges and resources compared to other regions. Factors such as healthcare infrastructure, availability of resources, and regional healthcare policies could significantly influence the findings. Therefore, the results may not be directly applicable to healthcare systems in different countries or regions without considering these contextual differences.

4. **Self-Reported Data**: The reliance on self-reported data for assessing knowledge and attitudes introduces the potential for response bias. Participants might overestimate or underestimate their knowledge and attitudes, leading to inaccurate representations of the actual levels. This limitation is inherent in survey-based studies and highlights the need for objective assessments to complement self-reported measures.

5. **Limited Scope of Knowledge Assessment**: The study used a specific set of multiple-choice questions to assess knowledge about subcutaneous fluid administration. While MCQs are effective for certain types of knowledge assessment, they may not capture the full breadth of understanding or practical skills related to hypodermoclysis. Expanding the assessment tools to include practical evaluations or case studies could provide a more comprehensive understanding of healthcare professionals' competencies.

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Appendices

Appendix 1: Canberra Health Services

Procedure

Subcutaneous Fluid Replacement in the Elderly (Hypodermoclysis)

Contents

Purpose

This document provides Canberra Health Services (CHS) staff with best practice information for insertion, management and cessation of hypodermoclysis in elderly patients. In addition, the document is a source of information for educating and supporting patients and their carers receiving the therapy within the hospital environment.

Hypodermoclysis is the process of rehydrating a patient by administering isotonic fluids into the subcutaneous tissues.

Alerts

The following fluids are contra-indicated for subcutaneous fluid administration:

- Hypotonic fluids without electrolytes
- Hypertonic fluids
- Dextrose 5%. [1,2]

Scope

This procedure applies to subcutaneous administration of fluids in the elderly, within the hospital setting.

Subcutaneous fluid replacement in the elderly is ordered by a Medical Officer and is administered by a Registered Nurse (RN)/Enrolled Nurse (EN).

This document applies to the following staff working within their scope of practice:

- Medical Officers
- Nurses and Midwives
- Students under direct supervision.

Appendix 2: Sections

Section 1 – Patient criteria

Subcutaneous fluid administration for rehydration is given:

- To mildly dehydrated patients in which rehydration can occur at a slower rate
- To cognitively impaired elderly patients who have poor oral intake/hydration
- As a substitute for patients with poor peripheral intravenous access.
- As treatment of choice in the sub - acute setting.[1]

The advantages of subcutaneous fluid administration compared to intravenous fluid administration are:

- Ease of administration
- Low incidence of infection
- Minimization of pain or discomfort
- Does not require cannulation.

The following conditions are contra-indications for subcutaneous fluid administration:

- Shock
- Severe dehydration
- Severe electrolyte imbalance
- Clotting disorders

- Generalized oedema
- Severe heart failure
- Acute Myocardial Infarction
- Skin infections. [1,2]

Adverse reactions to subcutaneous fluid administration can include:

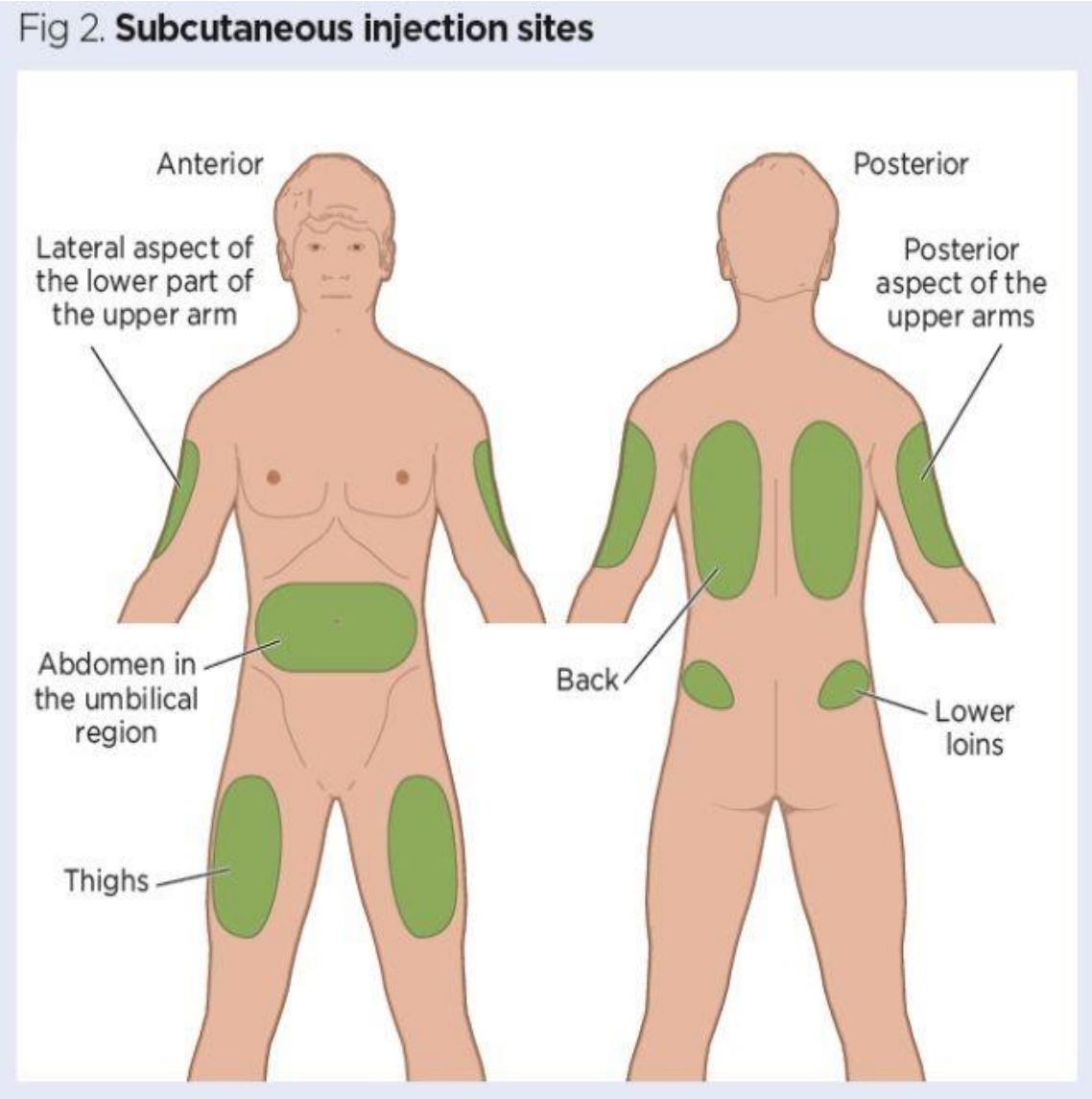
- Local inflammation/swelling
- Pain/tenderness
- Bruising/bleeding
- Leakage at butterfly site/extravasation
- Peripheral oedema
- Respiratory distress/pulmonary oedema
- Cellulitis
- Abscess formation
- Tissue necrosis. [1,2]

Section 2 – Site selection, insertion of subcutaneous line

Assessment of the patient must occur prior to the insertion of subcutaneous line, including a comprehensive skin assessment.[1, 2] (see Water low Risk Assessment Tool for Pressure Injury Prevention, found on the clinical forms register, to assess the skin).

Suitable sites for subcutaneous infusion include:

- Infraclavicular region
- Abdomen
- Back
- Shoulder
- Thigh



Areas of bruising/oedema/infection/scar sites/moles are not suitable for insertion and absorption.

The site of administration may depend on the patient's cognitive status. The upper back or shoulder has been found to be the ideal infusion site for confused and agitated patients. They are less aware of the placement of the subcutaneous administration line and therefore less likely to remove it.

Site rotation/replacement

- The infusion site should be rotated after every 1 Liter (L) of fluid administered.
- The subcutaneous site should be replaced every 72 hours or if adverse signs develop (see section one).[1, 2]
- The subcutaneous line can remain insitu for repeat use post 24 hours from last infusion

Standard Aseptic Technique procedure

- Insertion of a subcutaneous infusion line is a Standard Aseptic Technique procedure as per the CHS Peripheral Intravenous Cannula, Adults and Children (Not neonates), on the policy register provided standard aseptic non-touch technique can be performed by experienced staff without touching key areas (i.e. insertion site).
- If staff do not feel confident to complete the procedure without touching these areas, then sterile gloves must be used. Please refer to CHHC Aseptic Non-Touch Technique procedure on the policy register.
- If the subcutaneous needle is contaminated during insertion, it must be discarded and replaced prior to reinsertion.

Section 3 – Procedure of insertion of subcutaneous line

Equipment

- Dressing trolley
- Dressing pack
- 24 gauge winged plastic cannula e.g. BD Safe-T-Intima- 24 gauge safety system with Y adapter
- 70% Alcohol with 2% Chlorhexidine swab
- Occlusive Transparent film dressing e.g. Tegaderm (10cm x 12cm) or IV3000 (10cm x 14cm)
- 10mL Syringe
- Sodium Chloride 0.9% 10mL ampoule or pre-filled Sodium Chloride 0.9% syringe
- Drawing up needle
- Needleless Injection Cap, such as safe site or care-site (luer lock compatible)
- Clean gloves
- Protective glasses, goggles or shield
- Sharps container
- Alcohol Based Hand Rub (ABHR)

Procedure

1. Staff must consult with the medical officer responsible for the patient's care prior to insertion, to ensure the subcutaneous line and fluids are required, alternatives should be taken into consideration.
2. Identify the indication and written order for fluid replacement in the patient's clinical records. Fluid orders are to be written on the Intravenous Fluid Chart, clearly indicating the subcutaneous (sub cut) route, fluid type, volume, rate, duration, date and time, printed prescriber's name and signature, and any other relevant information (such as "commence if oral fluid intake is below a certain volume within a 24 hours period").
3. Select a winged cannula for subcutaneous insertion with sharps safety features to ensure sharps injury protection, and upon removal leaves a polyurethane cannula only in the patient.
4. Wash hands or use Alcohol Based Hand Rub (ABHR).
5. Explain the procedure to the patient and obtain informed verbal consent, if appropriate, as per CHS *Consent and Treatment policy*.
6. Position patient comfortably.
7. Conduct positive patient identification procedure as per CHS Clinical Procedure, *Patient identification and procedure matching*.
8. Check the patient's history for any contraindications, such as for clotting disorders (refer to section one) and allergies, including allergies to antiseptics (e.g. chlorhexidine or iodine) or dressing products.
9. Ensure the privacy of the patient is maintained throughout this procedure.
10. Don personal protective eye wear.

11. Wash hands or apply ABHR.
12. Open dressing pack onto cleaned dressing trolley and open equipment.
13. Select the most appropriate subcutaneous site for insertion of winged infusion line.

    Consider the following:

    - Patient's activity level
    - Cognitive status
    - Indication and expected duration of subcutaneous line.

    Avoid areas of:

    - Broken skin
    - Bruising
    - Bleeding
    - Inflammation
    - Infection
    - Scar tissue
    - Oedema
    - Pain
    - Moles
    - Ensure insertion on the abdomen maintains a 5 cm radius from the umbilicus.
14. Prepare site for injection as necessary. Remove hair using clippers to assist with dressing adhesion. Clean visibly dirty skin with neutral soap and water.
15. Wash hands or apply ABHR.
16. Don gloves.

17. Prepare saline filled syringe, attach needless injection cap to winged infusion set, prime line with normal saline.
18. Clean site with 70% Alcohol with 2% Chlorhexidine swab and allow to dry for at least 30 seconds.
19. Remove needle cap/cover on subcutaneous winged infusion line.
20. Pinch up a fold of skin and insert needle at 15-to-45-degree angle (depending on the amount of subcutaneous tissue at the site). [1, 2]
21. After insertion stabilize the line and release the skin.
22. Apply transparent dressing over winged infusion set.
23. Hold inserted line securely with one hand whilst withdrawing the sharp (pull on the opaque cylinder at the y junction, until sharp removed from line).
24. Dispose of sharp into sharps container.
25. Insertion site should always remain visible.
26. Dispose of used equipment appropriately.
27. Remove gloves and wash hands/use ABHR
28. Remove Personal Protective Equipment, as per CHS Healthcare Associated Infections Procedure, on the policy register.
29. Perform hand hygiene.
30. Clearly record the date and time of insertion on the transparent dressing.
31. Document procedure date time, site and line used as soon as possible in the patient's clinical records and nursing care plan.

Section 4 – Subcutaneous line post insertion care and management

The subcutaneous cannula site must be observed and documented in the nursing care plan and patient's clinical records each shift, upon patient repositioning and/or when accessed for subcutaneous fluid administration. The site should be assessed to ensure:

- there are no signs of infection present
- the therapy is not causing inflammation or swelling
- the insertion site is clean, dry and the dressing is intact.

Observation of the subcutaneous cannula site

1. Explain procedure to patient and ensure the patients privacy.
2. Wash hands or apply ABHR.
3. Observe dressing ensuring that the dressing is dry and intact.
4. Palpate the insertion site for tenderness, ask the patient if it is painful.
5. Check the insertion date is legible and that it is within the 72-hour dwell time.
6. Observe the patient for signs of oedema and the site for any signs of redness, pain/tenderness, inflammation, swelling, leakage at the butterfly site, bruising, bleeding, abscess formation, or extravasation.
7. If there are any adverse signs remove the subcutaneous cannula and notify the relevant Medical Officer. Initiation of removal is by a RN/ EN or a Medical Officer only.
8. Document the patient line observation in the clinical records and care plan each shift.

9. The Medical Officer is to review the requirement of the subcutaneous line daily and document the indication for ongoing use of the line or the requirement for removal.
10. Redress the sub cut cannula site as required.

Redressing the site

Indication

The subcutaneous cannula site should be redressed if the dressing becomes soiled, damp or loose

Equipment

- Sterile dressing pack
- 70% Alcohol with 2% chlorhexidine swabs
- Occlusive transparent dressing e.g. Tegaderm (10cm x 12cm) or IV3000 (10cm x 14cm)
- Clean gloves
- Protective glasses/goggles/face shield
- ABHR

Procedure

1. If redressing required, explain procedure to the patient and ensure privacy.
2. Wash hands or use ABHR.
3. Prepare equipment.
4. Position the patient comfortably.
5. Wash hands or use ABHR.

6. Don gloves and protective eye wear
7. Position the patient comfortably.
8. Remove and discard the soiled dressing.
9. Observe site for signs of redness, pain/tenderness, inflammation/swelling, leakage at the insertion site, bruising/bleeding, abscess formation, or peripheral oedema.
10. Remove the line if the above signs are present, notify the Medical Officer and refer to section 4.
11. Secure subcutaneous cannula with occlusive transparent dressing.
12. Dispose of the equipment appropriately
13. Wash hands or use ABHR.
14. Clearly record the date and time of insertion on the occlusive transparent dressing, and document date, time, site and position of line as well as dressing change in the patient's clinical records and nursing care plan.
15. The insertion site should remain visible at all times.

Section 5 – Subcutaneous fluid administration

Subcutaneous infusion rates

- Infusion rate should be slow. Recommended rate: 20mL/hr up to 83mL/hr (1L in 12 hours)
- Maximum administration volume per site is 1L in 24 hrs.
- Maximum total subcutaneous fluid replacement of 2L over 24hrs (over minimum of two sites).[1, 2]

Types of Fluid Recommended

- 0.9% sodium chloride
- 4% dextrose with 0.18% sodium chloride

Equipment

- Intravenous (IV) administration set/line
- Infusion pump
- 'Subcutaneous' route identification labels for line, as per *National Standard for User applied Labeling of Injectable Medicines, Fluids and Lines procedure*
- Intravenous fluids as prescribed e.g. 0.9% sodium chloride or 4% dextrose with 0.18% sodium chloride
- 70% alcohol with 2% chlorhexidine swab
- Extra gauze
- Clean gloves

Procedure

1. Verify medical officer's subcutaneous fluid order on the Intravenous Fluid Order Chart and select prescribed fluid.
2. Confirm positive patient identification as per CHS Patient Identification and Procedure Matching Procedure on the policy register.
3. Confirm intravenous fluid bag for subcutaneous infusion with authorized personnel as per CHS *Medication Handling policy.*
4. Explain the procedure to the patient, gain verbal consent if appropriate and ensure privacy.
5. Check patient does not have allergies to fluid or equipment to be used.
6. Wash hands or apply ABHR.
7. Using aseptic non- touch technique assemble equipment, prime lines including all associated connections, ensuring no air is present within the administration set and close clamp. Hang newly primed administration set and fluid on an infusion stand.
8. Set up BRAUN pump as per fluid order.
9. Wash hands or apply ABHR.
10. Don clean gloves – Standard Aseptic Non-Touch Technique (ANTT) as per CHS *Aseptic Non-Touch Technique procedure*.
11. Clean needleless injection cap on the subcutaneous cannula with 70% alcohol with 2% chlorhexidine swab for 10 seconds, allow to drying for 30 seconds.
12. Using ANTT, attach IV giving set to needleless injection cap.
13. Commence BRAUN pump program as per pump protocols.
14. Discard equipment and remove gloves.

15. Wash hands or apply ABHR.
16. Label infusion line as per *National Standard for User applied Labeling of Injectable Medicines, Fluids and Lines procedure*.
17. Document date and time of commencement of infusion in patient clinical notes and fluid balance chart.

Section 6 – Troubleshooting

Issue	**Possible Solution**
Redness at insertion point	Re-site infusion may be required
Pooling of fluid at insertion point	Reduce flow rate – possible massage area may help. Re-site infusion if problem persists.
Fluid overload / wheeze / breathlessness	Unlikely with rate less than 80 ml / hr. If suspected fluid overload, stop infusion and notify MO for Review.
Persistent redness / localised pain / swelling / unexplained pyrexia.	Stop infusion and notify doctor.
Leaking from site after removal of cannula	This will resolve spontaneously.

Section 7 – Subcutaneous fluid cessation and line removal

Subcutaneous lines are removed and/or replaced:

- As soon as they are no longer clinically required OR
- When there are signs of adverse reactions or inflammation/oedema/infection OR
- Within 72 hours of insertion.

Equipment

- Gauze swab
- Occlusive transparent dressing or injection site pressure pad
- Adhesive removal wipe
- Safety goggles
- Clean gloves
- ABHR

Procedure

1. Explain the procedure to the patient, gain consent and ensure the patients privacy.
2. Wash hands or apply ABHR.
3. Prepare equipment.
4. Wash hands or apply ABHR.
5. Don Gloves and protective eye wear.
6. Cease subcutaneous fluid administration.

7. Loosen occlusive dressing with adhesive removal wipes for fragile skin as required.
8. Grasp the subcutaneous line wings firmly and slowly withdraw the subcutaneous line, checking that the line is intact on removal.
9. Apply pressure to the site with gauze or injection pad.
10. Inspect for insertion site for signs of inflammation or infection.
11. Apply occlusive dressing.
12. If insertion site is infected notify Medical Officer for review
13. Update Fluid balance chart.
14. Document in the patient's clinical records the line removal, site assessment.

الملخص

الخلفية: إعطاء السوائل تحت الجلد، والمعروف باسم انحلال الجلد، هو وسيلة بديلة لتوصيل السوائل، وخاصة في المرضى المسنين. تكتسب هذه الطريقة شهرة بسبب بساطتها وفعاليتها من حيث التكلفة والحد الأدنى من التدخل مقارنة بالطرق الوريدية التقليدية. على الرغم من الفوائد الموثقة جيدًا لإدارة السوائل تحت الجلد لدى المرضى المسنين، إلا أن اعتمادها محدود بسبب اختلاف مستويات المعرفة والتصورات والمواقف بين المتخصصين في الرعاية الصحية.

الأهداف: الهدف الرئيسي من هذه الدراسة هو تقييم المعرفة والإدراك والمواقف من المتخصصين في الرعاية الصحية في شمال فلسطين تجاه استخدام السوائل تحت الجلد في المرضى المسنين.

المنهجية: أجريت هذه الدراسة المقطعية في شمال فلسطين وشارك فيها متخصصون في الرعاية الصحية من مختلف المستشفيات. تم جمع البيانات من خلال استبيان تمت إجراؤه ذاتيًا والذي قام بتقييم معرفة المشاركين وتصوراتهم ومواقفهم تجاه إدارة السوائل تحت الجلد. وتضمن التحليل تقييم متوسط درجات عناصر المعرفة والمواقف واستكشاف التأثيرات الديموغرافية المحتملة.

لنتائج: تكونت العينة بشكل رئيسي من الممرضات (60.4%) والذكور (58.5%). تراوحت أعمار نسبة كبيرة من المشاركين بين 21 و30 عامًا (56.7%)، وحصلوا على درجة البكالوريوس (78.7%)، ولديهم 1–5 سنوات من الخبرة المهنية (32.3%). كان متوسط درجة المعرفة بشأن إدارة السوائل تحت الجلد 62.3% ± 19.6%، حيث أظهر 45.7% من المشاركين مستويات معرفة منخفضة و37.8% أظهروا معرفة متوسطة. والجدير بالذكر أن الأطباء والمهنيين الصحيين المتحالفين لديهم درجات معرفة أعلى بكثير مقارنة بالممرضات (ع = 0.002). بالإضافة إلى ذلك، أظهر 53.2% من الأطباء و38.9% من المهنيين الصحيين المساندين مستويات معرفة متوسطة، حيث أظهر 21.3% من الأطباء مستويات معرفة عالية (ع = 0.011). وكانت درجات الموقف تجاه إدارة السوائل تحت الجلد إيجابية بشكل عام، بمتوسط درجة 81.6٪ ± 12.4٪. حوالي 67.7% من المشاركين لديهم سلوك جيد، و29.3% لديهم سلوك مقبول. ترتبط المستويات التعليمية العليا بمواقف أكثر إيجابية تجاه إدارة السوائل تحت الجلد (ع = 0.022). وكان العائق الأكثر

شيوعاً هو الافتقار إلى التدريب الكافي، وخاصة بين الممرضات، حيث حدده 51.8% كعائق رئيسي. لم يتم العثور على ارتباط كبير بين درجات المعرفة والمواقف (ع = 0.097)، مما يشير إلى أن المعرفة والموقف تجاه إدارة السوائل تحت الجلد قد تعمل بشكل مستقل في هذه الفئة من السكان.

الاستنتاجات: تؤكد النتائج على ضرورة برامج التدريب المستهدفة لتعزيز المعرفة والمواقف لدى المتخصصين في الرعاية الصحية تجاه إدارة السوائل تحت الجلد في المرضى المسنين. تعد معالجة هذه الفجوات التعليمية أمرًا بالغ الأهمية لتحسين الممارسات السريرية ونتائج رعاية المرضى في إدارة الترطيب لكبار السن.

الكلمات المفتاحية: إدارة السوائل تحت الجلد، المرضى المسنين، المتخصصون في الرعاية الصحية، شمال فلسطين.