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Soap and water or disposable wet wipes - A mixed methods study

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DOI (link to publication from Publisher):
10.54337/aau517402491

Publication date:
2022

Document Version
Publisher's PDF, also known as Version of record

COMPARISON OF TWO WASHING METHODS FOR BED BATHS: SOAP AND WATER OR DISPOSABLE WET WIPES – A MIXED METHODS STUDY

BY
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DISSERTATION SUBMITTED 2022

AALBORG UNIVERSITY
DENMARK

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by

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Dissertation submitted 2022

Dissertation submitted: Juli 2022

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PhD Series: Faculty of Medicine, Aalborg University
Department: Department of Clinical Medicine
ISSN (online): 2246-1302
ISBN (online): 978-87-7573-868-7

Published by:
Aalborg University Press
Kroghstræde 3, DK – 9220 Aalborg Ø
Phone: +45 99407140, aauf@forlag.aau.dk, forlag.aau.dk

Printed in Denmark by Stibo Complete, 2022

English summary

Introduction and background:

Bed baths are offered to hospital-admitted patients if they cannot get out of bed during admission. Besides ensuring the patients' personal hygiene, bed baths have many advantages and can be crucial to patients' quality of life. Soap and water (SAW) have gradually been replaced by a more widespread use of disposable wet wipes (DWW). In Denmark, the two methods are both recommended. Still, the evidence for the use of both methods is sparsely elucidated. Knowledge and evidence about SAW and DWW are important elements in nursing staff's clinical decision-making (CDM) regarding choice of washing method for a bed bath. In particular, three factors are relevant in the choice of washing method for bed baths: evidence for the effectiveness of SAW and DWW to remove microorganisms (MOs) on the skin, the patients' perspective on the use of SAW and DWW for bed baths, and knowledge about cost. This PhD aimed to address these factors by investigating the use of SAW and DWW for bed baths, using both qualitative and quantitative methods.

Aim:

The overall aim of this PhD study was to provide new insights into the use of SAW and DWW for bed bath and thereby contribute to increased quality of CDM regarding bed bath practices for bedridden patients.

Methods:

The PhD study was based on a mixed methods research design that included three individual studies. In study I, a block-randomized cross-over design was employed to compare the efficacy of SAW and DWW to remove microorganisms (MOs) on the skin. Skin swabs from the groin and perineum of 72 admitted patients before and after washing with SAW and DWW, respectively, were microbiologically analysed and compared. In study II, qualitative interviews were conducted with 16 hospitalized, bedridden patients who had received bed baths with both SAW and DWW. The aim was to explore the patients' perspectives on the use of SAW and DWW for bed baths. Study III was a scoping review, which aimed to identify relevant operating and capital costs in previously published cost analyses for bed bath washing methods. The mixed methods findings and results were integrated through narrative weaving.

Results:

In study I, no significant difference in the effectiveness of the two washing methods to reduce the amounts of MOs in the groin and perineum was found, but the total number of MO species was significantly reduced after washing with both methods. Furthermore, new types of MO species appeared after washing, regardless of which method was used. The patients in sub-study II preferred SAW to DWW, since it gave a sense of cleanliness, which was considered essential in social relations. In specific situations, DWW were preferred, for example, to freshen up. Washing the face and hands was thought to require special care, and hands should be washed at least once a day. Although patients would like to have the opportunity to be involved in the decision regarding choice of washing method, for them the important thing was to be washed. Study III identified a lack of transparency and structure in nine published cost analyses for washing methods, which makes it unclear whether there is a real difference in the costs between SAW and DWW. Despite this, the literature shows that DWW requires less time than the use of SAW. Relevant running costs, capital costs and consequences of washing methods were identified for SAW and DWW. The themes of integrated findings were: *"Shared clinical decision-making regarding choice of washing method for bed bath"*, *"Freshening up or feeling really clean"* and *"Cleanliness in social relations"*.

Conclusion:

Effectiveness of washing methods, the individual patients' preferences and costs are important perspectives to consider in the shared clinical decision of washing methods for bed baths. Overall, the patients would like to have the opportunity to be involved in the clinical decision regarding choice of washing method for bed baths. However, the most important thing, in their opinion, was to be washed.

SAW was preferred for bed baths and handwashing and DWW was preferred in specific situations. The patients distinguished between "freshening up" and being "really washed" and cleanliness was essential in social relationships. There was no difference in the effectiveness of the two washing methods to remove MOs and it is unclear if there is a difference in the cost between SAW and DWW. Although the use of DWW seem to require less time than the use of SAW.

Dansk resume

Introduktion og baggrund:

Sengebade tilbydes patienter hvis de ikke kan komme ud af sengen under indlæggelsen. Udover at sikre patienternes personlige hygiejne har sengebade mange fordele og kan være afgørende for patienternes livskvalitet. Brugen af vand og sæbe (VOS) ved sengebade er gradvist blevet erstattet af en mere udbredt brug af vaskeservietter (VAS). I Danmark anbefales begge vaskemetoder men metoderne er sparsomt belyst. Viden om VOS og VAS er vigtige elementer i plejepersonalets kliniske beslutnings tagen (KBT) om valg af vaskemetode ved et sengebad. Tre væsentlige områder der kan inkluderes i den kliniske beslutning er: Viden om VOS og VAS i forhold til deres effektivitet i reduktion af mikroorganismer (MO) på huden, patienternes perspektiv på brugen af VOS og VAS til sengebade og omkostningerne ved metoderne. Ph.d. projektets formål var at belyse disse områder ved at undersøge brugen af VOS og VAS til sengebade ved hjælp af både kvalitative og kvantitative metoder.

Formål:

Det overordnede formål med dette ph.d.-projekt var at få indsigt i og belyse brugen af VOS og VAS og derved bidrage til at kvalificere den kliniske beslutning om vaskemetode ved sengebade for indlagte patienter.

Metode:

Ph.d.-projektet var designet som et mixed metode studie der inkluderede tre del-studier. I delstudie I blev der anvendt et blok-randomiseret cross-over design, hvor hudpodninger fra lyske og perinæum på 72 indlagte patienter før og efter vask med de to metoder blev mikrobiologisk analyseret. I delstudie II analyseres kvalitative interviews med 16 indlagte sengeliggende patienter. Formålet var at udforske patienternes oplevelser ved at blive vasket med VOS og VAS. Delstudie III var et scoping review. I ni studier, analyseres relevante drifts- og kapitalomkostninger i omkostningsanalyser for vaskemetoder til sengebad. Resultater og fund fra delstudie I, II, og III blev integreret gennem ”narrative weaving”.

Resultater:

Delstudie I viste ingen signifikant forskel på de to vaskemetoders effektivitet i reduktion af mængden af MO i lysken og mellemkødet, men den samlede mængde af MO blev reduceret signifikant efter vask med begge metoder. Derudover blev der observeret nye MO arter efter vask, uafhængigt af hvilken metode der blev anvendt. Patienterne i delstudie II foretrak brugen af VOS frem for VAS, da det gav en følelse af renlighed, hvilket blev anset for at være afgørende i sociale relationer. I særlige situationer var VAS den foretrukne vaskemetode til at blive frisket op. Vask af ansigt og hænder blev anset som specielle områder, og hænder bør vaskes mindst en gang om dagen med sæbe. Selv om patienterne gerne vil have mulighed for at blive inddraget i beslutningen om valg af vaskemetode, var det vigtigste for dem at blive vasket. Studie III identificerede manglende gennemsigtighed og struktur i omkostningsanalyser for vaskemetoder. Dette gør det uklart, om der er en reel forskel i omkostningerne mellem VOS og VAS selvom tidsforbruget er mindre ved brug af VAS. Relevante drifts- og kapitalomkostninger samt konsekvenser ved vask med VOS og VAS blev identificeret. Temaer for de integrerede fund var: *"Fælles klinisk beslutningstagen om vaskemetode ved sengebadet"*, *"At blive frisket op eller føle sig rigtigt ren",* samt *"Det at føle sig ren i sociale relationer"*.

Konklusion:

Effektiviteten i reduktion af MO, patienternes præferencer og omkostninger er vigtige perspektiver at overveje i en fælles klinisk beslutning om vaskemetode ved et sengebad.

Patienterne ville gerne have mulighed for at blive inddraget i den kliniske beslutning om valg af vaskemetode til sengebade, men det vigtigste var at blive vasket. VOS foretrækkes til sengebade og håndhygiejne og VAS i specielle situationer. Patienterne skelnede mellem at blive "frisket og op" og blive "vasket rigtigt ren", hvilket var var afgørende i sociale relationer. Der var ingen forskel i de to vaskemetoders effektivitet i reduktion af MO og det er uklart, om der er en forskel i omkostningerne mellem VOS og VAS, men tidsforbruget ser ud til at være mindre ved brug af VOS end ved VAS.

Acknowledgements

Many people have contributed to me being able to start, conduct and complete my PhD study. I am grateful to each of them for supporting my efforts, each in their own way.

Firstly, a very big and warm thank you to my principal supervisor, Jette Primdahl, who, from our first meeting, had confidence that I could complete the PhD study. I am grateful for your time and commitment, which in our conversations has helped me on the right path in the countless challenges, discussions, and changes that have been going on throughout the process.

Thanks to my co-supervisors Ming Chen, Christian Stab Jensen, and Jan Sørensen for inspiring professional conversations, guidance and your positive approach to the project being carried out.

A big thank to patients and staff who agreed to participate in this study and who have spent their time helping me. Thanks to the centre managers, the nursing director, and the PhD students, and to the hygiene nurses and the staff at the Microbiological Clinic, at University Hospital of Southern Denmark, Sygehus Sønderjylland. Thanks to the statisticians from University Hospital of Southern Denmark, Sønderborg, and Open Patient data Explorative Network (OPEN).

Thanks to Jan Sørensen for inviting me several times on study visits and to be part of your research community in Dublin, and for organizing a seminar for research students in Dublin. Thanks to Dr Declan Patton, Senior Lecturer and Director of Nursing and Midwifery Research, Royal College of Surgeons in Ireland, RCSI, School of Nursing, for inviting me to hold a seminar and discuss my research with PhD students at the nursing school.

The biggest thanks go to my family, who have been there for me throughout the process, with loving words, support, and an invaluable belief in me. The loveliest thanks to Christian, and to Julia and Emilie and their families.

Finally, I would like to acknowledge the financial support that made the research possible. Unrestricted funding was provided by the University of Southern Denmark, the Region of Southern Denmark, University College South Denmark, and Sygehus Sønderjylland, University Hospital of Southern Denmark

List of publications

Attached in Appendix F

Paper I:

Pia L. Veje, Ming Chen, Christian S. Jensen, Jan Sørensen, Jette Primdahl,

Effectiveness of two bed bath methods in removing microorganisms from hospitalized patients: A prospective randomized crossover study. Published: American Journal of Infection Control (AJIC) 6. Dec. 2019 https://doi.org/10.1016/j.ajic.2019.10.10.011 [1].

Paper II:

Pia L. Veje, Ming Chen, Christian S. Jensen, Jan Sørensen, Jette Primdahl,

Bed Bath with soap and water or disposable wet wipes: patients' experiences and preferences. Published: Wiley Journal of Clinical Nursing (JCN) 9. Feb. 2019 DOI: 10.1111/Jocn. 14825 [2].

Paper III:

Pia L. Veje, Jette Primdahl, Ming Chen, Christian S. Jensen, Jan Sørensen,

Costs of bed baths: A Scoping Review of Methodology. Published: Nursing Economic; Vol.38 Iss. 4.(Jul/Aug 2020): 194-202 [3].

Tables and figures

Tables:

Figures:

List of acronyms

ABC	Activity-Based Costing
CDM	Clinical Decision Making
CFU	Colony-Forming Units
CMD	Clinical Microbiological Department
DWW	Disposable Wet Wipes
EAC	Equivalent Annual Cost
HAUTI	Hospital-acquired urinary tract infections
MO	Microorganism
RCT	Randomized controlled trial
SAW	Soap and Water
SNOSE	Sequentially Numbered Opaque Envelopes

Table of contents

Chapter 1. Introduction

The inspiration for this PhD study goes back to my time as a nursing student. The most interesting lectures for me involved practical skills and hygiene. Procedures, such as giving bed baths, meant that you were physically close to others. I found this profoundly interesting, and essential to professional nursing.

This led me to the subject of my master's thesis, a qualitative investigation of how elderly hospitalized patients experience the process of receiving help with intimate hygiene [4].

Later, practical skills, procedures, the evidence supporting procedures, and hygiene as a topic, became my focus as a teacher at the nursing school, as well as in contributions to projects, papers, and book chapters. Through my teaching in procedures for bed baths and intimate hygiene, I came to realize that there was a lack of evidence-based knowledge for the different washing methods. This led to this PhD study.

One of the first texts that describe bodywash and bathing methods for patients is Florence Nightingale's "Notes on Nursing" from 1859 [5]. Since then, procedures and techniques for personal hygiene have been a central element of nursing activities. Florence Nightingale's texts were based on the technology of soap and water (SAW), as the means to achieve cleanliness, and SAW has been crucial to modern professional nursing practice since 1859 [6-9]. Given that soap came into mainstream use for personal hygiene in the mid-1800s [10, 11], SAW was also used for body washing in nursing.

In 1994, Susan Skewes introduced disposable wet wipes (DWW) as a method for body washing [12]. They were first used in nursing practice in the United States and later in other parts of the world, including Denmark [13-31]. From around the turn of the millennium, there has been an increased use of DWW as an alternative to SAW, not only in Danish hospitals, but also in home care, nursing homes and society in general [28-30, 32-36]. The increasing use of DWW has challenged patients and nursing staff, and the technology was not unequivocally welcomed in the primary sector, and both nursing staff and patients have expressed their concern about quality of care in relation to DWW [37-39].

SAW and DWW are both recommended in various Danish hospital- and national guidelines and textbooks [40-47]. These guidelines are included in the clinical decision

process and therefore evidence-based knowledge for the two washing methods are important in clinical decision-making (CDM) [48, 49]. This thesis presents work investigating the use of SAW and DWW for bed baths in hospital settings, using a mixed methods approach with both qualitative and quantitative studies. The PhD study aimed to provide a deeper and more nuanced understanding of the two washing methods for bed baths, with the overall aim of contributing to qualifying the CDM.

Guide to the reader

The thesis consists of nine chapters and a set of appendices. The thesis is based on three sub-studies, and the related published papers are attached in Appendix F. The papers should be considered as a main part of the thesis and constitutes each their element in the mixed methods approach.

In Chapter 2, the background of washing methods is described, along with the structured literature search describing the state of the art. The chapter summarizes the rationale for the thesis. Chapter 3 presents the overall aim and the aim of each sub-study. Chapter 4 describes the overall mixed methods research design and the integration levels across sub-study I, II and III. In Chapter 5, the methods for the singular research design of the three sub-studies are presented. Chapter 6 presents selected key findings and the results of the sub-studies, as documented in the published papers. In addition, additional findings and results are presented. In Chapter 7, the mixed methods findings, results, and research design are discussed, along with a discussion of the methods used in the individual sub-studies. Additional discussions of the results and findings in the individual sub-studies can be found in the published papers in Appendix F. Chapter 8 reports the conclusion and Chapter 9 describes future research and implications for clinical practice.

Chapter 2. Background

2.1 Bed bath practices

Bed baths are offered to hospitalized patients if they cannot get out of bed to wash or shower during admission. It is estimated that more than 600,000 bed baths are performed each year at Danish hospitals [50, 51]. Bed baths ensure patients' personal hygiene, which involves a wide range of procedures. These may include washing the body, intimate hygiene, oral care, foot care, skin care, nail care, hair care and handwashing [40-44, 47]. Bed baths can be necessary due to pain, reduced mobility or when patients are dying, critically ill, or in the case of other factors and diagnoses [14, 18, 52-54].

2.1.1 The use of bed baths

Besides ensuring the patient's personal hygiene, the literature shows that bed baths have many additional advantages [6-8, 54-58]. To get a bed bath can be crucial to patients' quality of life, [7, 56, 59], health promotion, social acceptance and well-being and can enable patients to relax [4, 6, 7, 18, 44, 55, 57]. In addition, it affects physical parameters, such as blood pressure and heart rate [60], can stimulate blood circulation, and provides fever relief [7, 54, 55, 61]. The need for personal hygiene may vary according to age, gender, ethnicity, diseases, fever and mobility [54].

It also appears that washing has a significant positive impact on dementia, in relation to, for example, aggression, agitation and well-being [62-65], and washing may prevent delirium and reduce agitation in intensive care patients [66, 67].

In addition to feeling fresh and clean, having a pleasant odour, and feeling comfortable, the risk of infections may be reduced by removal of visible dirt and transient microorganisms (MOs) [45, 61, 68-72]. It is difficult to show a scientific causal link between skin flora, amounts of bacteria, washing and infections [68-73]. However, there seems to be a link between pathogen bacteria in the meatus area and in the urine in catheterized patients and these pathogen bacteria pose a risk of hospital-acquired urinary tract infections (HAUTI) [68, 69, 72].

The process of how to perform a bed bath is described in various ways in the literature, [20, 28, 40-44, 47, 54, 74-76]. Despite the many different descriptions and guidelines, a

bed bath is most often performed in a certain order. First, the patient's face is washed, then the arms, the body, the legs, the back, and finally intimate hygiene. Despite guidelines and the identified certain order, bed baths can be performed very diversely. Performance depends on the experience and competences of the staff, the patient's individual and current condition, body appearance, diagnosis, and strengths [54, 77]. Furthermore, a bed bath may be characterized by diversity, complexity, coordination, planning, cooperation and communication between staff, patients and relatives, along with dialogue about what is possible, appropriate, and desirable in the specific situation [76].

The definition of a bed bath applied in this PhD thesis is *assisting with personal hygiene to bedridden patients who are too frail and immobile to shower having a full or partial bath in bed with help from the nursing staff* [18, 20, 40, 44, 75]. An example of a bed bath procedure as it is understood in this thesis is given in Appendix A.

2.1.2 Washing methods

Many technologies other than SAW and DWW are used for bed baths. These include washing gloves, towel baths, washing tunnel and washing robot [18, 35, 62-64, 73, 78-82]. SAW and DWW are the most frequently used technologies for bed baths and for that reason they are the focus of this PhD study.

It was not possible to identify any studies reporting on the number of bed baths or instances of intimate hygiene using SAW or DWW in Danish health care services. Internationally, two studies were identified that quantified the use of SAW or DWW [54, 83]. In intensive care units in Australia, 71% used SAW [54] and a larger multicentre study from the US covering 75 hospitals, found that 56% used SAW for patients with indwelling catheter [83].

2.1.2.1 Soap and water for bed baths

When using SAW for bed baths, a wash basin with temperate water, disposable foam washcloths, soap, and towels are used [40-47]. Experiences from clinical practice show that challenges when using SAW are to keep the water at the right temperature during the bed bath procedure; the wash basins must be cleaned; and patients can experience the foam washcloths as hard and rough.

Wash basins may constitute a microbiological reservoir and can be contaminated with pathogen MOs coming from the patients' own flora, from the environment or from other patients [84, 85]. Some patients may have more bacteria on the skin after the use of wash basins for bed baths than before [86]. This is important because skin bacteria may be the same as those found in the patient's urine potentially being the cause of HAUTI [68, 69, 72]. Therefore, the US Centre for Disease and infection Control recommends the elimination of reservoirs, such as wash basins, in the environment, and that alternative washing methods be investigated [87].

Additionally, washing the skin with SAW poses risk for the skin and the skin barrier function [11, 25, 61, 88-92]. Soap removes the natural layer of fat and the resident flora, alters the pH of the skin, affects the water content of the skin, and may increase the risk for pressure ulcers [25, 88, 89, 91, 93]. Furthermore, soap may also cause microvascular damage and can be cell toxic [11]. The skin irritant effect, dry skin, and changes in pH on the skin may increase the risk of infections [25, 54, 61, 88, 93, 94].

2.1.2.2 Disposable wet wipes for bed bath

DWW were invented in 1994 by Susan Skewes under the brand name "Bag Bath" [12]. Many different brands and types of DWW are on the market today, with varying ingredients, including disinfectants, and varying numbers of wipes in the pack [14-21, 28-30, 54, 93, 95-97]. DWW consists of several washcloths or paper wipes, moistened in a mixture of water and non-rinseable cleanser. The DWW are packaged in a single, closed plastic bag. Since the invention of DWW, SAW has been gradually replaced by a more widespread use of DWW for patients who need a quick and easy bed bath. DWW have been found to be timesaving, easy to use and are claimed to incur lower costs [15, 17-21, 28-30, 54, 96, 97].

The demand for increased productivity in health care [98] and the potential lower cost of DWW may be contributing factors for the increased use of DWW for bed baths. DWW were originally intended to be used for intensive care patients [12, 14] but, today, they are used for many other patients in primary care [28, 30], and private sector as well [27, 32, 33, 99].

DWW is a cosmetic product that may contain allergenic ingredients [99, 100]. Because of this, Danish legislation and tender terms and conditions specifying specifications for DWW have been enforced [101-103]. This PhD thesis assesses only the one brand and type that were used at the study hospital.

There is a great diversity in the discourse regarding designations for DWW. Table 1 lists the majority of these encountered in the literature [7, 12-33, 54, 61, 73, 78, 90, 93, 95-97, 100, 104-106].

Table 1: Designations for disposable wet wipes

In English	**In Danish**
Bag baths, wipes, wet wipes, disposable wet wipes, single use disposable wipes, alternative washing, innovative washing, travel-bath, wash without water, basinless, pre-packaged washcloths, rinse-free	Engangsvaskeklude, engangsklud, engangsbad, våd-vaskeklude, vådserviet, vådklud, sengebadsservietter, vaskeservietter, ”hurtigvask”, citronklude, weekend vask

References [7, 12-33, 54, 61, 73, 78, 90, 93, 95-97, 100, 104-107].

DWW have benefits for the patients, including a lower risk of cross-contamination, both between patients and on the individual patient, as no washbasin is used [7, 13, 14, 54, 93]. It also appears that DWW can improve the skin barrier function [12, 13, 16, 61, 89, 108, 109]. Additionally, skin irritations, such as pressure ulcers and dermatitis, may be prevented when using DWW over time, compared to SAW [7, 24, 25, 61, 64, 104, 105, 109]. However, an Australian systematic review [97, 105] did not find statistically significant differences in the number of pressure ulcers between these two washing methods. Furthermore, there can be a reduced risk for redness, scaly skin, skin flakes and cracks in the skin when using DWW, compared to other washing methods [13, 61, 90, 104]. Nevertheless, two large randomized studies [18, 23] did not find any significant difference between SAW and DWW in skin integrity and barrier properties [18] or on physiological parameters, humidity and skin pH level [23].

These findings are supported by a Cochrane review [73], which concludes that various *"emollient interventions"* may improve skin moisture in certain areas of the body compared to other traditional interventions (e.g., SAW use). However, they also conclude that *"We do not have sufficient evidence to determine the effects of hygiene and emollients in maintaining skin integrity among older people in residential and hospital settings"* [73].

DWW leaves some ingredients on the skin and therefore a cool and wet sensation or a greasy and sticky feeling immediately after drying can be experienced [19, 23, 100]. If the skin is left moist, the risk of getting fungus and intertrigo (skin against skin friction that can cause lesions, eczema and infections) increases, for example in skin folds [110].

2.2 Clinical decision regarding washing method for bed bath

In CDM, professional judgement is applied in choosing the washing method for the bed bath for the individual patient.

There are various definitions of clinical decision-making and clinical judgement [48, 49, 111, 112]. Based on the works of Benner [113] and Tanner [111], Gillespie & Patterson [48, 49] formulated a practical CDM framework to guide nurses' CDM analysis, and therefore Gillespie and Patterson's framework and definition are used in this thesis.

According to Gillespie & Patterson [48, 49], a clinical decision process is a professional estimate of the actions that will be proportionately meaningful, feasible, ethical, and effective for both the patient and the staff. It includes knowing the profession, the self (nursing staff), the case (general knowledge of the patient's actual medical situation), the actual patient's data, medical treatment, and the patient's individual preferences and resources [48, 49]. The professional estimate thereby includes facts that can be based on evidence, personal knowledge, experience, and preferences from both the patient and the staff, rules, routines, and availability of resources [48, 49]. In addition, the profession's core values, theories, models, and methods, together with patient's needs, observations, skills, and judgment should also be included [48, 49]. The context of a clinical decision, which includes the micro level (patient and nursing staff relationship), meso level (nursing unit and health care agency) and macro level (profession, society and government), also

influences the CDM [48, 49]. The organizational framework may include the availability of resources, e.g., bed bath methods, along with costs and staff time.

Thus, all the elements mentioned above may be included and will influence the final clinical decision regarding the most appropriate washing method chosen for the bed bath. Therefore, in relation to CDM, a literature search was required, to identify the evidence of washing with SAW and DWW, but also to delimit the scope of the investigation and search. The three main elements chosen as the focus in this thesis are: 1) evidence in relation to comparing the efficiency of the two washing methods; 2) patients' experiences and preferences regarding the use of SAW and DWW for bed baths; and 3) comparing the cost of the two washing methods.

2.3 Literature search

A systematic literature search on bed bath methods was carried out in three stages [114, 115]. An initial search was performed to identify relevant keywords [116]. Next, a systematic search in databases (published and peer-reviewed studies) and a search for relevant grey literature (published in forms other than peer-reviewed journals) were performed. Manual searches were also performed, based on reference lists in the most relevant articles [117]. Languages for the included studies were limited to Danish, Swedish, Norwegian, and English. The systematic searches were carried out in six databases: PubMed (Medline) (international literature), CINAHL (nursing-relevant literature), Scopus (relevant to citation search), Embase (European literature), Cochrane library (systematic reviews) and Prospero (Published protocols for systematic literature search). In each database, registers were first searched with all keywords and free text keywords were searched with truncation. In addition, a predefined search filter for qualitative studies, developed at the university library at the University of Southern Denmark, was used. Grey literature, such as reports, theses and other online documents was searched for in Google Scholar, as well as on Bibliotek.dk.

The Danish/Nordic search terms used were:

> *engangsklude, engangsservietter, vådserviet, engangsbade, vaskeservietter, vask, vand, sæbe, vaskefade, håndklæder, vaskeklude, grundlæggende sygepleje, nedre hygiejne, meatus toilette, sengebad, personlig pleje, personlig hygiejne, hygiejne, kropspleje, intim hygiejne, nedre toilette, vask forneden, stelle, kropsstell, grunnleggende sykepleie.*

English search terms were:

> *bath, travel bath, pre-packaged bath, traditional bath, Bag Bath, care, body care, skin care, wash, washing, waterless washing, washing without water, washing practices, cleans, cleaned, cleaning, wipe, disposable wet wipes, wet wipe, basin, bowl, towel, washcloths, soap and water, hygiene, intimate, personal hygiene.*

The literature searches were updated continuously by alerts from the databases until submission of the thesis. The results are presented in the following sections. For an example of the searches, please see Appendix B.

2.3.1 Effect on skin microbes when washing with SAW and DWW

A crossover study from the US by Larson et al. [14] on medical and surgical adult patients found a significantly increased count of bacteria at the umbilicus after washing with DWW, whereas the increase after washing with SAW was not statistically significant. In addition, they found a significant reduction of gram-negative bacteria in the groin after washing with SAW. No other significant changes from before to after washing were found in the study. They did not compare the difference in count of MOs from before to after washing, between SAW and DWW. However, they did compare the average count of MOs for each intervention separately and did not find any significant difference. The expected 0.5 log difference in MOs on the skin between SAW and DWW was not confirmed. The number of included participants was not in accordance with their power calculation, which could explain the lack of significance.

In a Turkish and a Swedish study, respectively, the number of MO species on the skin after washing with SAW and DWW was compared [33, 78]. The studies did not find any significant difference in the effectiveness to reduce MOs on the skin, between washing

with SAW or DWW. These two studies may be difficult to apply to other contexts, settings, and hospitalized patients, as the Turkish study investigated washing of infants, whereas the Swedish study used bacterial milk mixture as a controlled contaminant on the arm of healthy adults.

A Brazilian RCT assessed the effect of washing with SAW or DWW on 55 elderly bedridden hospitalized patients [20]. They swabbed the popliteal fossa before the first bath and after a fifth bath and only three washcloths per bed bath were used for SAW. For SAW, an increase in counts of MO was found and for DWW a decrease. Hence, the study found a significant difference between the two methods. With five baths between the assessments of the two washing methods' effectiveness in reducing MOs, the conclusions can be questioned, because several unknown issues could have influenced the results. Furthermore, the study discusses limitations of their results because only three washcloths per bed bath were used. Consequently, their results may not be trustworthy. This practice also differs from Danish guidelines [40-47].

Overall, the literature indicates a possible reduction in the amounts of MOs after washing with both SAW and DWW, but also an increased number of MO species, pointing to some form of contamination after washing with both methods [14, 20, 33, 78].

In conclusion, evidence regarding differences in the effectiveness to remove MO species from the skin between SAW and DWW is limited. Given this gap in the literature and the evidence indicating a link between MOs on the skin and in the urine causing HAUTI, there is a need for additional knowledge about the effectiveness of SAW and DWW in the reduction of MO species on the skin.

2.3.2 Patients' experiences with SAW and DWW

Several questionnaire studies conclude that patients have preferences for washing with DWW rather than SAW [18, 28-30, 104]. A quasi-experimental study from Iowa City Veterans Affairs Medical Center [104] found that DWW was preferred by 97% of the 60 included patients. This is in line with a Danish randomized crossover study using questionnaires to assess satisfaction and preferences for DWW or SAW among elderly patients on a medical ward [28, 50]. They found that 78% of the 58 included elderly

patients preferred DWW to SAW. Also, a Dutch cluster randomized study, performed in the primary health care sector, including 500 people, found that the citizens' general preference for DWW was 7.1 out of 10 points (SAW not rated) [18]. Contrary to these findings, a Danish/Faroese randomized crossover study [29] on patients admitted to medical/surgical wards concluded that there was no difference in the preference for the two types of bed baths. In the results section, they state that 61% of the 31 included patients preferred SAW; however, the results and analyses are hard to decipher.

Other questionnaire studies evaluated satisfaction rather than preference [12, 18, 30, 61, 118]. Patients are satisfied with DWW, and regard DWW as a worthy alternative to SAW, or they would even permanently trade SAW for DWW [12, 18, 61]. In line with this, a small Danish crossover RCT study on older adults in a home care setting concluded that 32% of the 20 included patients preferred towards DWW, and 42% preferred towards SAW [30].

The use of DWW may contribute to an experience of increased independence among patients because they can use them without the presence of the nursing staff [12]. However, some may experience the use of DWW as impersonal and it may be necessary to make the patients aware that washing with DWW is actually part of personal care [18].

In summary, questionnaire studies have identified an overall preference for, and higher satisfaction with, DWW for bed baths, compared to SAW. However, some studies discuss that there are mixed findings regarding preferences for SAW. It is difficult to decipher the results in relation to whether patients feel clean and well-groomed after bed baths with DWW, as the studies only asked for preference or satisfaction. Therefore, a more nuanced and in-depth knowledge is needed regarding the patients' experiences and preferences regarding the use of SAW and DWW for bed baths.

2.3.3 Costs of bed bath methods

Predominantly, the use of DWW for a bed bath seems to have lower costs than SAW when time use and thus the hourly costs for the nursing staff are included [14, 18, 19, 21, 28-30, 50, 95, 118]. However, a Dutch cluster randomized controlled trial (RCT) [18] and a systematic review [21] both concluded that the costs of the two washing methods were

almost the same. The great variations in recorded time consumption and hourly costs in the studies [13, 14, 18, 19, 28-31, 50, 80, 95, 104] seems to lead to differences in whether the cost of using DWW was found to be lower or similar to the use of SAW.

In addition, the abovementioned studies used various types of cost analyses without appropriate referencing to systematic standard methods, e.g. such as for example cost-minimization or cost-effectiveness analysis [119, 120]. Thus, there is a lack of transparency in the methods used to calculate and estimate the value of included resources in the identified studies. The direct costs may be calculated based on the actual resource consumption (operating costs), whereas the indirect costs [121] (consequences for the patients, such as infections, skin trouble, treatments and multiple bed days), seem not to be included.

Only parts of the costs are described, without any explanation of how their included resources were identified and valued. None of the identified studies on cost analyses considered whether there was a difference in the risk of complications associated with the washing methods.

In conclusion, the identified costs analyses for bed baths included various resources and are based on different methods for estimating time consumption. Based on this, it seems difficult to conclude whether DWW are more cost effective compared to SAW. Therefore, it is relevant to identify, value, and compare, in a systematic way, running and capital costs, including measurement of the time used in relation to the two types of bed baths.

2.4 Summary and rationale for this thesis

In summary, bed baths are offered to Danish hospitalized patients if they cannot get out of bed during admission. Besides ensuring the patient's personal hygiene, bed baths have many advantages such as personal well-being and reduction of MOs and thus, perhaps, a reduction of infection risk. The conventional method of using SAW for bed baths has gradually been replaced by a more widespread use of DWW and, in Denmark, the use of SAW and DWW as washing methods are both recommended.

The literature comparing the effectiveness of the washing methods in the reduction of MO species on the skin between SAW and DWW is limited. There seems to be a reduction in the amounts of MOs after washing with SAW and DWW. However, the evidence regarding whether there is a difference in the effectiveness to reduce MOs from the skin between SAW and DWW is sparse. Given finding in the literature and evidence indicating a link between MO species on the skin and in the urine, which may pose a risk of HAUTI [68, 69, 72], additional knowledge about the effectiveness of SAW and DWW to reduce MOs on the skin is needed.

Questionnaire studies have identified an overall preference for, and higher satisfaction with DWW over SAW for bed baths. However, some studies discuss that there are mixed findings regarding preferences for SAW. Therefore, it will be valuable to explore and elaborate further on patients' preferences for SAW or DWW.

The sparse explanations of the cost analyses in the studies examining washing methods make it difficult to conclude whether DWW are more cost effective, compared to SAW. Based on this it is found relevant to identify, value, and compare, in a systematic way, running and capital costs, including measurement of the time used for the two types of bed baths. However, as described later in the methodology section, findings from a pilot study and experiences during data collection led to a need to study the methodological conduct of such studies. The objective then became to identify good practice when analysing the resource use and cost of bed baths and, therefore, the element of comparing the cost of the two washing methods was planned as a scoping review.

Chapter 3. Overall aim and research objectives

Based on the rationale, the overall aim for the PhD study was:

> *To provide new insights into the use of SAW and DWW for bed baths, thereby contributing to increased quality of CDM of bed bath practices for bedridden patients.*

Three sub-studies, each with their objectives, were planned to contribute to this overall aim. The three sub-studies are presented in Table 2, including specific research objectives and research questions to be answered. The core scientific contributions of the thesis are documented in the three papers included in Appendix F.

Table 2: Overall aim, objectives, research questions and related papers for the three sub-studies

Overall aim: To provide new insights into the use of SAW and DWW for bed baths, and thereby contribute to increased quality of CDM for bed bath practices for bedridden patients.			
	SUB-STUDY I	**SUB-STUDY II**	**SUB-STUDY III**
Research objectives	To compare the effectiveness of SAW and DWW in reducing MOs in the groin and perineum of hospitalized patients.	To explore and nuance hospitalized, bedridden patients' experiences of, satisfaction with and preferences for either SAW or DWW for bed baths.	To conduct a scoping literature review of published scientific articles that have analysed the resource use and costs of providing bed baths.
Research questions	When health care professionals perform intimate hygiene on Danish hospitalized patients: Does washing with SAW or DWW reduce the microbial flora? Is there a difference in the effectiveness to reduce the amounts of MOs on the skin between washing with SAW or DWW?	How do Danish bedridden hospitalized patients experience bed baths with SAW compared with DWW? What are the preferences among bedridden hospitalized patients regarding bed bath washing methods? How are patients' needs met in relation to personal hygiene? What is the significance of cleanliness and feeling well-groomed and smelling good?	What does the existing literature tell us about the respective costs of different washing methods? Which resource variables are used for bed baths? What is the cost of a bed bath? How is time to perform a bed bath measured?
Paper	*I: Effectiveness of microbial skin flora removal from hospitalized patients: A prospective randomized cross-over study* [1]	*II: Bed Bath with soap and water or disposable wet wipes: Patients' experiences and preferences* [2].	*III: Costs of bed baths: A Scoping Review* [3].

Chapter 4. Research design

A mixed methods approach was chosen as the overall research methodology. Both quantitative and qualitative methodologies were considered necessary to address the identified research gaps concerning bed bath washing methods. The mixed methods approach and rationale of choosing this method are described in this chapter.

In this thesis, the integration of the three sub-studies occurs at the design level, methods level and at the interpretation and reporting level. The chapter includes a presentation of integration across sub-study I, II and III. The design of each sub-study, the methods, analyses, discussion of results and findings and integration of results and findings across the three sub-studies are illustrated in Figure 1.

4.1 Mixed methods

The overall research design in this thesis was a core convergent fixed mixed methods approach [122]. The PhD study included three sub-studies, in which both quantitative and qualitative methods were used to answer the overall aim, as presented in Table 2 in Chapter 3. A fixed design was used as the method was predetermined and planned at the start and a core convergent (concurrent) parallel design [122, 123] was used, because, while the three individual sub-studies informed each other, they had each their own singular methodology and data were analysed separately.

"In a convergent concurrent deign … qualitative and quantitative data collection occurs in parallel and analysis for integration begins well after the data collection process has proceeded or has been completed. Frequently, the two forms of data are analysed separately and then merged" [124] p. 5.

The rationale for choosing mixed methods was that the overall aim was complex and both quantitative and qualitative methodologies were necessary to answer the research questions of the three sub-studies and achieve the overall aim [123].

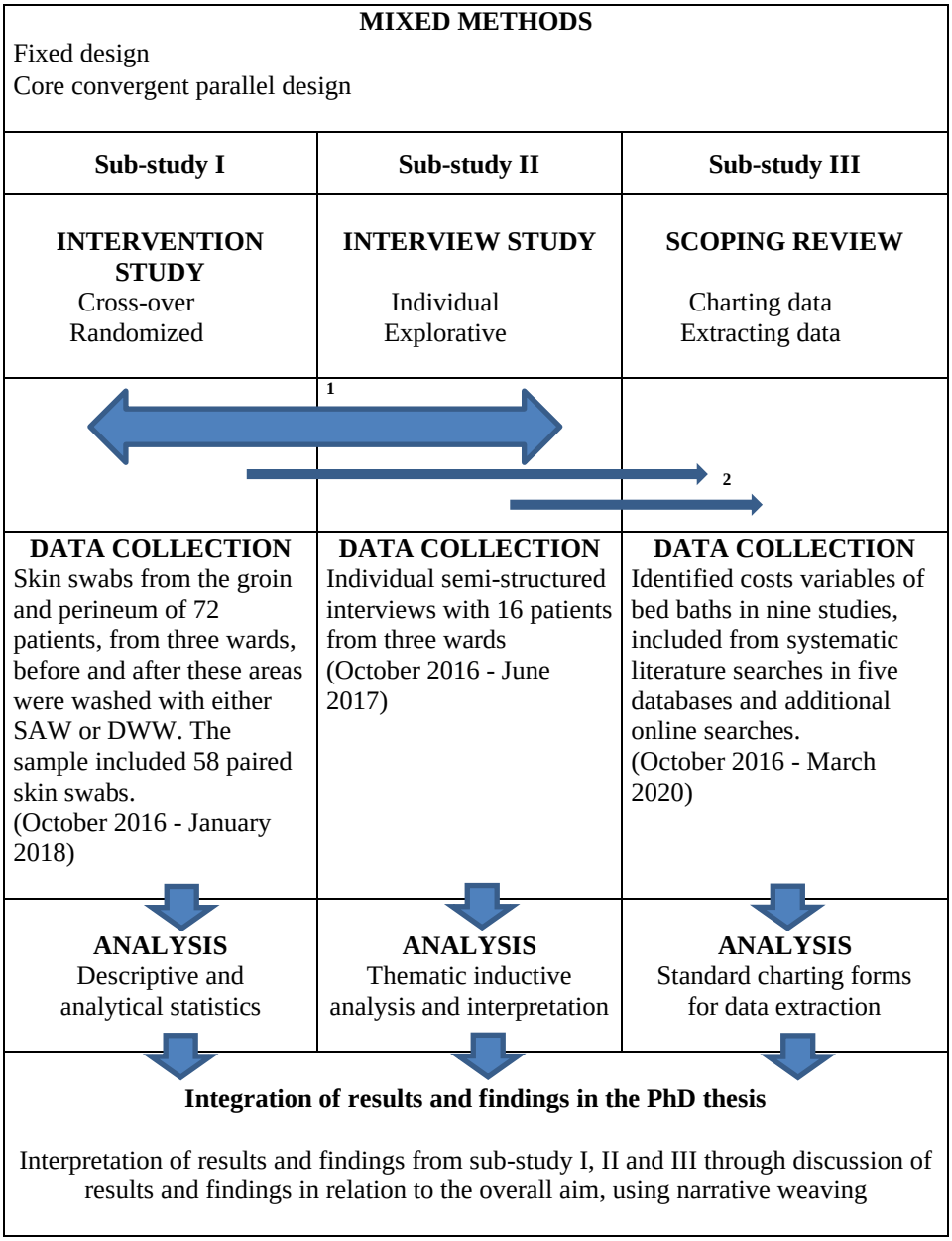

Figure 1: Overview of the singular methodology in the three sub-studies and their interconnection in the framework of the fixed convergent mixed methods research design with parallel data collection. [1]Data collection within the same timeframe. [2]Sub-study I and II informed sub-study III

A mix of both qualitative and quantitative methods is considered to go beyond what can be achieved from using only one of the two methods [124, 125]; the results from each sub-study can complement each other and strengthen the findings to achieve the overall aim [126, 127]. In this PhD-study, sub-study I was quantitative, using measurable data (counts of MOs on the skin), sub-study II was qualitative, encompassing subjective data (patients' experiences and preferences), and sub-study III was a scoping review, to identify the cost and resource elements of the washing methods for bed baths (Figure 1).

Mixed methods is described as an overall and relevant theoretical framework that allows integration of a variety of theoretical perspectives and methods [125, 128]. In mixed methods, qualitative and quantitative data can be combined, including their philosophical assumptions and approaches [129]. Thus, the mixed methods approach was considered both relevant and suitable to gain a more thorough and comprehensive understanding of washing methods for bed baths in accordance with the overall aim of the PhD study.

The birth of modern mixed methods research seems to be from the 1980s - 2000, where many pioneers systematically articulated and developed procedures and ideas about how to combine qualitative and quantitative research [123, 128]. Various definitions of mixed methods have emerged since Greene et al. emphasized the mixing of methods in 1989 [123]. Later, John Creswell synthesized the research and contributed substantially to the practicality of integration and method development [122, 123, 125, 129, 130]. In this PhD thesis, Creswell's definition and key characteristics of mixed methods methodology was applied:

"An approach to research in the social, behavioural, and health sciences in which the investigator gathers both quantitative and qualitative data, integrates the two, and then draws interpretations based on the strengths of both sets of data to understand research problems" (Creswell 2015) p. 2 [122].

The underlying philosophy of this PhD thesis adheres to pragmatism, in that it draws on and employs diverse approaches and values both objective and subjective knowledge [123]. According to John Creswell, and others [122, 123, 126, 127], pragmatism is an important, relevant, and meaningful philosophical assumption to support mixed methods research, because it offers epistemological justifications for mixing approaches and

methods. Pragmatism seems to be well suited to guiding the work of merging the two approaches, to achieve a greater understanding, and it provides an umbrella view for mixed methods studies [123]. Pragmatism acknowledges the epistemological differences between qualitative and quantitative approaches, but sees those as commensurable, and advocates for a shared aim for the research, thus accommodating the diverse nature of those approaches [131].

To employ a mixed methods approach, it is essential to learn about multiple approaches and methods, including how to integrate them appropriately. It was therefore important to identify the epistemology, methodology and distinctive methods of each sub-study. The three sub-studies were conducted and published individually, to accredit the singular method. The convergent design was found relevant within the timeframe of the PhD study. The participants for sub-study I and II were included from the same population, but the data were analysed separately, using separate analytic approaches [123]. Integration occurred at the design level, methods level, and interpretation/reporting level, as illustrated in Figure 1.

4.1.1 Integration at the design level

Integration at the design level was accomplished by way of the convergent design [122-124]. In a convergent design, the qualitative and quantitative data are collected and analysed during a similar timeframe and the data collection process often occurs in parallel. A parallel data collection for sub-study I and II was convenient and relevant in this PhD study, and it involved equal emphasis of the two sub-studies. Thus, the data collection for sub-study I and II took place concurrently, at three wards at the same hospital, during 2016 and 2017. For sub-study I, eligible patients who needed help with intimate hygiene during the morning tasks were identified and some of these patients who were going to have a bed bath/or had received a bed bath earlier, were also invited to participate in an interview, as part of sub-study II. The analysis of data from sub-study II was accomplished in 2018, before all data from sub-study I were collected and analysed. This was finalised in 2019. Observations of bed bath practices during data collection for sub-study I and II showed that it was complex to measure time spent and items used for a bed bath. The observations therefore led to the conversion of sub-study III from a time

and motion study to a scoping review, as mentioned in the rationale for the thesis. This is in line with Creswell, stating that an iterative process, for choice and change of method, may proceed during data collection [122, 124].

4.1.2 Integration at the method level

Integration at the method level occurred by linking the methods for data collection and analysis. The methods were integrated through "connection" and "building" [124]. Integration through connection occurs when data are linked together through the sampling framework and from the same population [124]. Some of the participants in sub-study I and II participated in both sub-studies. Integration through building occurs when the results from one type of data collection informs another procedure [124]. Sub-study I and II provided an understanding of bed bath practices, which was necessary for sub-study III. Building does not usually occur within convergent approaches [122], but because of the link between data collection in sub-study I and II and the analyses in sub-study III, it is referred to as building in this thesis. It manifested itself through the fact that observations of bed bath practices during sub-study I and II inspired the development of the charting forms used in sub-study III.

4.1.3 Integration at the interpretation level

In a convergent design, the qualitative and quantitative data are analysed singularly before merging (integration) [124]. Therefore, the results from sub-study I, II and III were reported in separate papers in this PhD thesis. This is a staged approach to integration, which also occurred through narrative weaving [124]. The findings from sub-study I, II and III are merged in the discussion chapter (Chapter 7), to explore insights of the complexity of bed bath washing methods through narrative weaving. The narrative weaving approach was used to integrate findings from the three sub-studies, through a unifying analysis, interpretation, and discussion. Weaving involves writing both quantitative and qualitative findings together on a theme-by-theme basis [124]. Narrative weaving shows the integration of data across the studies and supports new understandings beyond the conclusions described in each of the three sub-studies. Potential coherence (fit) of the quantitative and qualitative findings was discussed through confirmation, expansion and discordance [124]. Confirmation is when results and findings from the three sub-

studies confirm each other or expand insights into the narrative themes. Discordance occurs if the findings from the three studies diverge or contradict each other, are inconsistent or disagree with each other.

4.2 Setting for the data collection

An intensive care unit, a medical ward, and a surgical ward at a regional Danish university hospital were identified by the hospital purchasing manager as the wards with the most frequent use of DWW. Therefore, these three wards were chosen as the setting for the data collection in sub-study I and II. The management staff on the wards were contacted, informed about the study, and asked if the ward was interested in supporting the research. After approval by the management, preliminary information meetings were held between the PhD student, departmental managing nurses and ward nurses in the wards. The departmental managing nurses disseminated both written and oral information about the study and the PhD student to the staff in the participating departments.

4.3 Ethics

The study was performed in accordance with the ethical guidelines for nursing research in the Nordic countries, published by the Nordic Nurses' Federation [132]. Furthermore, the studies followed guidelines developed by the World Medical Association [133] and implemented by The Danish National Comitee on Health Research Ethics [134, 135]. The staff obtained verbal consent from interested eligible patients that the PhD student could come and inform them further about sub-study I and II. If a patient was interested, additional oral and written information was provided by the PhD student. This material can be found in Appendix C and D (both in Danish). In cases where the patients wanted to participate, they signed written informed consent forms. The readability level of the participant information and consent forms for sub-study I and II were assessed using the Gunning's Fog Index [136, 137] to estimate the required schooling level to be able to read and understand the text. This was performed to ensure that the text was comprehensible

and easy to read for patients. The study was registered in Clinical Trials (SDUSF - 2015 - 65RI - (205)). The local Regional Scientific Ethics Committee confirmed by email that a formal ethical registration and approval was not required [135]. Formal registration to store the data by the Danish Data Protection Agency (no.18/35356) [134, 138] was obtained through the participating hospital.

Chapter 5. Methods

This chapter contains information about the methods of sub-study I, II and III, including information about aim, methodologies, participants, data collection and data analysis. The descriptions are based on the published papers in Appendix F [1-3], with additional elaboration and explanations. For sub-study I, this includes elaboration of methodology and description of the pilot study. For sub-study II, an additional description of the methodology and an example of the 5-step coding method are given. For sub-study III, a pilot study and the overall methodology framework are elaborated.

5.1 Sub-study I

The aim of sub-study I was to compare the effectiveness of SAW and DWW in reducing MOs in the groin and perineum areas of hospitalized patients. The methodology is reported in Paper I, entitled *"Effectiveness of two bed bath methods in removing microorganisms from hospitalized patients – A prospective randomized cross-over study"* [1], Appendix F.

Method

A positivistic philosophy of science, as described by the French philosopher and sociologist August Comte (1798-1857), was applied [139]. In this thinking, observations are without any prerequisite and are theory independent, and the observer is a passive recipient. The data collection is thus considered to represent pure, objective and neutral reflections of the world, a source of safe and valid knowledge, achieved through measuring, weighing and counting observations [139].

Based on the rationale for this PhD thesis, it was relevant and appropriate to investigate whether there was a difference in the reduction of MOs on the skin after washing with SAW or DWW. Sub-study I was therefore planned as a crossover RCT [1]. A crossover RCT allows for a comparison of two interventions and reduces selection bias [140]. This empirically experimental method has the analytical purpose of testing or rejecting a pre-formulated hypothesis (the falsification theory) [141].

The zero hypothesis [141] was that there would be no difference between the two interventions in the reduction of MOs from before to after washing. A crossover design [142-146] was chosen, because it only required the inclusion of half the number of patients, compared to parallel designs, as the participants became their own controls [145, 146]. Hereby, the study's operating costs were also minimized and it eliminated inter-subjective variations [143]. All included patients received both washing methods, in a predetermined sequence [144].

Pilot study

A pilot study was conducted to test the processes of the main study before conducting the full crossover RCT [147]. The objectives of the pilot study were threefold: to obtain data for a power calculation, to gain experience in collaborating with the departments, and to test methods and workflows. In February 2015, imprint plates and cotton swabs were tested for efficiency in collecting microbes in the perineum and groin of bedridden patients over a period of two weeks on a surgical and medical ward respectively. The pilot study showed that it was more appropriate to collect MO using cotton swabs as the imprint plates were too large for use in the groin and perineum. Based on the pilot study, a power calculation was carried out, based on a 0.5 standard deviation. A power of 80% and an alpha value (p-value) of less than 5%, corresponding a confidence level of 95%, was set. Assisted by a statistician, the power calculation concluded that it was necessary to include 62 patients, who all had to be washed with both washing methods and swabbed before and after each washing method. Results from the pilot could not reach a statistically significant conclusion on the efficiency of each intervention.

Study population and recruitment

Eligible patients were identified in accordance with the selection criteria shown in Table 3, reproduced from Paper 1 [1]. The decision as to whether it was relevant to assess eligibility was taken by the day-shift nurse who cared for the patients. The inclusion period lasted from October 2016 to January 2018, in an intensive care unit, a medical ward, and a surgical ward at a Danish university hospital. The patients' demographic data were collected by direct questions and observations.

Table 3: Selection criteria for sub-study I [1]

Inclusion criteria	Exclusion criteria
• Patients >18 years of age • Patients in need of help with intimate hygiene • Patients hospitalized for a minimum of 2 consecutive days • Patients able to understand oral and written information in Danish • Patients able to sign a written consent for the study	• Patients with diarrhoea • Patients in isolation • Terminal patients • Patients waiting for elucidation • Patients already washed • Patients who declined participation

Randomization and blinding

A block randomization method was used with sequentially numbered, opaque sealed envelopes (SNOSE) [148, 149] containing information about the results of the randomization. Randomization to group A was intimate hygiene with SAW on the first day, and DWW the second day. Randomization to group B was DWW the first day and SAW the second day. Because the blocks should be shareable by number of interventions (2), they were set at four. This yielded six different possible combinations for the sequence of washing method for each block of four patients ((1) AABB, (2) BBAA, (3) ABAB, (4) BABA, (5) ABBA and (6) BAAB). The sequence was determined by rolling a die. A secretary not involved in the study packed each envelope with four smaller envelopes with one block combination in each, in accordance with the SNOSE method. Randomization occurred immediately after inclusion.

A blind cultivation, inspection and classical microbiological analysis were performed at the Clinical Microbiological Department (CMD) at the hospital. Data from interventions were blinded for the statistical analysis by guidance from statisticians and supervisors.

Data collection

The method to obtain skin swaps was based on international principles [87], in accordance with infection control guidelines at the hospital and the hospital guidelines for skin swabs,

transportation and storage [150]. The materials and tools used for both washing methods were standard for all hospitals in the region. Clinical skin swabs were performed in the groin and perineum immediately before and after washing with SAW or DWW on all included patients on two consecutive days. The wash-out period, defined as the time for restoring MOs on the skin after washing (the time between washing and possible swapping), [146] was determined to be 12-24 hours. Groin and perineum were chosen as relevant areas to swab, because MOs that causes HAUTI are often found in the patients' own flora and are likely to be from areas related to intimate hygiene [45]. In addition, both areas are ideal for MO growth, due to moisture, skin folds and covering [14, 72]. The same side of the groin was used for swabs on both days and the same person performed all the swabs, using sterile equipment and an aseptic technique [87, 151]. Cotton swabs were moistened with sterile water and were swiped across an area of about three by three cm, using a pressure similar to that of a paintbrush [14, 53]. Information about the study and instructions regarding intimate hygiene, in accordance with hospital guidelines [46], were provided to the staff in advance of washing, and the information was repeated during washing. Washing with SAW was performed with soap, washcloths, basins, and towels. Washing with DWW was performed with prepacked moist disposable wet wipes. All the swabs were stored and transported in Stuart's transport medium to the CMD at the hospital, where cultivation, inspection and classical microbiological analyses were performed [152, 153]. The subsequent extraction of data from the CMD database included the determination of the colony-forming units (CFU) for all MO species in all swabs. The raw data for CFU per MO were delivered from CMD as either 'few', 'some' or 'many'. Details can be found in Appendix F, Paper I.

Statistical analyses

The statistical analyses were chosen based on the data structure (ordinary data), and paired design (dependency) [146]. The analyses were performed using the statistical software programme STATA/IC version 15.1 and were carried out with guidance from statisticians. All identified MO species were included in the analyses and two categories were used: number of MO species and amounts of MOs.

The number of MO species refers to the number of different MO species that were present on the skin of a participant. The number of MO species varied between patients. If an MO

species was identified only after washing the patient, it was defined to be zero before washing.

The number of CFU for each MO species was converted to 1 (few), 2 (some) and 3 (many) on an ordinal dimensionless scale. A change on the ordinal scale corresponding to one was considered clinically relevant [155]. In addition, a difference of one may be decisive for the choice of treatment with, for example, antibiotics. For each participant, the CFUs were accumulated before and after each washing method.

The cause of current hospitalization was encoded in six categories: investigation, infection, cancer, surgical, medical, and others. In addition: sex, skin problems, ulcers, urinary tract catheters, stoma, diaper use, antibiotic use and diabetes were coded as binary variables (0/1) for descriptive analyses. A possible carry-over effect was analysed by including a dependent variable expressing the sequence (AB or BA) in the logistic regression analysis [156]. It identified whether the result was the same whatever order of bed bath methods was given. This was also tested by using two-sample Wilcoxon rank-sum test by order of treatment [156]. Wilcoxon matched-pairs signed rank test [156, 157] was used to analyse the paired data sets in relation to reduction in amounts of MOs. Furthermore, the two-sample Wilcoxon rank-sum test was used to analyse data for patients with *E. coli*.

5.2 Sub-study II

The aim was to explore, and nuance hospitalized, bedridden patients' experiences of satisfaction with, and preferences for, either SAW or DWW bed baths. The methodology is reported in Paper II, entitled *"Bed Bath with soap and water or disposable wet wipes: Patients' experiences and preferences"* [2], found in Appendix F.

Methodology

The study was qualitative, based on a hermeneutic-phenomenological approach [158-161]. This approach was considered suitable to an understanding of how individuals experience a common, unexplored phenomenon, such as preferences for and experiences of different bed bath methods [158, 161, 162]. The Danish philosopher D. Zahavi's

description of four key elements within phenomenology was applied [161, 163]: (1) the phenomenon; (2) the first-person perspective, such as descriptions of experience; (3) the requirement to go to the point of life itself, 'epoche', understood as putting one's own prejudices and preconceptions aside; and (4) the world of life, a pre-scientific world of experience that we take for granted, in which we live and experience, and which consists of the individual's experiences, skills, opinions and values. The phenomenological approach [161] formed the interview and the five-step coding method applied in the data analysis explained below.

The interviews were intended to create an understanding of a phenomenon from the interviewed person's perspective, to unfold the meaning and importance of their experiences of bed bath methods, with the intention of setting aside the interviewer's preconceptions [158, 161].

H. G. Gadamer describes in his hermeneutic philosophy [164], the key elements: prejudice (understanding) and fusion of horizons (new understanding) in the situation. The hermeneutic approach (prejudice) informed the formulation of the research questions, and the development of the semi-structured interview-guide Appendix E. Furthermore, the hermeneutic approach formed the interpretation of the final themes from the five-step coding method, in what Gadamar describes as horizon fusion.

The seven stages of an interview: thematizing, designing, interviewing, transcribing, analysing, verifying and reporting were applied, as described by S. Kvale and S. Brinkman [158]. This enabled thoughtful decisions to be made regarding choice of methodology, available methodological options, ethical implications and anticipated consequences of the methodological choices for the entire interview [158].

Individual, in-depth interviews were chosen because they allow the interviewer to delve deeply into personal experiences. It is a widely used method to co-create meanings with interviewees, by reconstructing their perceptions and experiences related to healthcare [165].

Study population and recruitment

In the inclusion period, eligible patients were identified in accordance with the selection criteria by the dayshift nursing staff who cared for the patients. Selection criteria for sub-study II are displayed in Table 4, reproduced from Paper 2 [2].

The inclusion period lasted from October 2016 to June 2017, in an intensive care unit, a medical ward, and a surgical ward at a regional Danish university hospital.

Table 4: Selection criteria in sub-study II [2]

Inclusion criteria	Exclusion criteria
• Bedridden patients • Patients who had experienced bed baths with DWW for a minimum of two days • Patients who had experienced bed baths with SAW • Able to speak and understand Danish fluently • Able to understand written and oral information • Able to sign a written consent form	• Dementia • Terminal patients • Patients who declined participation • Patients who the staff assessed it would be unethical to ask

M. Q. Patton's [166] purposeful sampling strategy, including maximum variation, was applied. Patton states that sampling in qualitative studies may be achieved by purposeful sampling, because they typically focus on in-depth knowledge and a relatively small number of participants. To ensure heterogeneity in patient characteristics, the strategy of maximum variation was applied, using the causal-field method, as described by S. Wacherhausen [167]. Factors assumed to affect experiences of bed bath methods were identified in the literature, through clinical observations and from the researcher's prior knowledge. These factors included: sex, age, occupational background, cohabitation status, type of ward, length of admission, diagnosis, bariatric information, skin issues, stoma, and information regarding use of urinary catheter, diaper and if the patients required bariatric equipment. This information was used in a matrix for participant

inclusion. The sampling strategy was intended to maximize the diversity of experiences relevant to the research questions and was considered to be suitable for an unexplored phenomenon, such as experiences and preferences regarding bed bath methods.

Data collection

A semi-structured interview guide was developed [158]. This type of interview seeks to obtain descriptions of the interviewee's lifeworld and allows openness to different forms of questions during the interview. The interview guide (Appendix E) contained a thematic dimension related to the research question, e.g., bed bath with DWW, and a dynamic dimension, expressed in everyday language. The interview guide was developed based on the interviewer's previous experience, and conceptual and theoretical knowledge [168]. The questions were kept brief and easy to understand. Academic concepts were avoided to promote a positive interaction, to optimize conversation flow and encourage the participants to talk about their experiences [158]. The interview guide contained six to eight questions, as recommended by J. M. Morse and L. Richards [169]. All interviews were planned to last maximum one hour and were digitally recorded and transcribed verbatim by the interviewer. The interviews were conducted face-to-face, in separate, undisturbed consultation rooms at the ward or at the bedside. Participants were included until no additional information appeared in three consecutive interviews.

Data analysis

The software programme, Nvivo version 11.4.3, was used to structure the data, support a systematic analysis, helps reinforce completeness and allows flexibility in the revision of the analytical process [165]. Kvale and Brinkman's [158] five-step coding method was employed, as illustrated in Table 5.

The first step was to read all the interview transcriptions to achieve an overall sense of all the interviews. The second step was an open initial coding, where natural meaning units, as expressed by the participants, were identified. The third step was to thematise these units, as understood by the interviewer/researcher. The fourth step was to link natural meaning units in themes across the transcripts. The fifth and final step was to condense the initial themes into main themes [158].

Table 5: Example of the five-step coding method

<table>
<tr><th colspan="4">1. Reading the text</th></tr>
<tr><th>2. Natural meaning units, as explicitly expressed by the participants</th><th>3. Natural meaning units themed by interviewer</th><th>4. Themes are linked across interviews</th><th>5. Condensation of final themes into main themes</th></tr>
<tr><td>Hands should be washed at least once a day with soap and water
Soap, so the hands are clean when I’ve been to the toilet</td><td>Hands need soap and water at least once a day
Hands must be cleaned after toilet visits</td><td>Theme:
Hands should be washed with soap and water at least once a day</td><td rowspan="3">Cleanliness of hands and face

Hands and face are special body areas. There are preferences and needs in relation to washing them which are different from the rest of the body</td></tr>
<tr><td>Soap on the face is not good</td><td>No soap on the face</td><td rowspan="2">Theme:
The face has preferences other than soap and water or wipes</td></tr>
<tr><td>I don’t like disposable wet wipes on my face</td><td>No disposable wet wipes on the face</td></tr>
</table>

The interpretation was inspired by S. Kvale and S. Brinkman [158] and addressed the identified overall themes in three interpretational contexts, described as: self-understanding, critical common sense understanding and theoretical understanding [158].

Self-understanding expresses the participant’s experience in the transcribed interviews as rephrased and condensed statements.

In the critical common-sense understanding, the interpretation goes beyond the rephrased and condensed themes, while remaining within the context of common sense. This context provides a wider understanding, including general knowledge, which amplifies and enriches the condensed themes. Some of the patients’ self-understanding and critical common-sense understanding are presented as findings in Chapter 6. In the Discussion,

Chapter 7, interpretation in the third context, 'theoretical understanding' goes beyond the participants' experiences of bed baths.

5.3 Sub-study III

The aim of this sub-study was to identify good practice when analysing the resource use and cost of bed baths. The methodology is reported in Paper III, entitled *"Costs of bed baths: A Scoping Review of Methodology"* [3], found in Appendix F.

Pilot study

A pilot study, following recommendations from Arin et al. [147], was conducted in 2015 for a period of two weeks in a medical ward. The purpose of the pilot study was to obtain data – by way of a questionnaire – on resource items and time used during bed baths. The questionnaire was completed by the nursing staff in relation to bed baths for eight patients. The pilot study showed a large variety in items and time used for a bed bath and it became clear that it was relevant to identify, in a systematic way, running and capital costs and how to measure the time used.

Initially, the intent was to conduct a time and motion study to obtain quantitative data for time consumption. However, observations during sub-study I and II showed that there were interruptions from other staff during bed baths, unexpected reactions from the patients, and changes in the patient's condition during a bed bath. Combined with the results from the pilot study questionnaire and observations, sub-study III was therefore planned as a scoping review.

Methodology

The framework for a scoping review developed by H. Arksey and L. O'Malley [170], and enhanced by many others [171-174], was used.

The reporting of the scoping review was done in accordance with Preferred Reporting Items for Systematic Reviews and Meta-analysis for Scoping Reviews (PRISMA-ScR) guidelines [175]. A scoping review represents an increasingly popular approach for literature reviews in health care research [174, 176] and is particularly used when the

literature search is of a complex, heterogeneous nature. Scoping reviews are used to summarize and disseminate research findings, to identify gaps, develop overviews and to make recommendations for future research [171, 173, 177]. Furthermore, a scoping review does not include a formal quality assessment of the included studies. The scoping review was developed based on five stages, as recommended by H. Arksey and L. O'Malley [170]. Stage one involved identifying the research questions; in stage two, relevant studies were identified; stage three was the selection of relevant studies (without quality assessment); in stage four, data from the studies were charted; and stage five involved collating, summarizing, and reporting the results, which are presented in Chapter 6.

Stage one: identifying questions:

The following questions arose from the research questions in the thesis and were used in charting and summarizing the data from the included studies.

1) What does the literature tell us about the respective costs of different washing methods?

2) Which resource items were used for a bed bath?

3) What was the cost of a bed bath?

Stage two: identifying relevant studies:

A systematic literature search [115] was conducted to identify relevant published, scientific papers that reported on empirical analyses of the resource use and costs of bed baths. Table 6 shows inclusion criteria based on the framework: Participants, Concepts and Context [173, 178].

Table 6: Inclusion criteria for sub-study III

Participants (P)	All – No age limit and regardless of country, setting, demographic factors, disease, diagnosis and whether they require a bed bath or similar.
Concept (C)	Traditional bed bath interventions using soap and water, regardless of utensils and guidelines. The equipment typically included a basin, water, towels, washcloths, and soap. Including all bed bath interventions other than soap and water, not limited to any specific type, brand, or content of disinfection agents. The interventions typically comprised cloths, wipes, or towels pre-moistened or with no-rinse cleaner.
Context (C)	All designs, where cost and resources used for bed baths were reported from a hospital nursing management perspective

The search strategy was performed in three steps: an initial search, systematic searches in selected databases and search for non-peer-reviewed literature [173]. An initial scoping search was undertaken to identify relevant keywords and search terms, which were checked with truncations and whether they were defined as index terms in the databases. The applied search terms are presented in Table 1, Paper 3 in Appendix F [3]. A search for published peer-reviewed studies in five databases was performed from their individual inception date until the end of March 2019. The selected databases were PubMed (international literature), CINAHL (relevant nursing literature), Scopus (relevant for citation search), Embase (European literature) and the Cochrane library (systematic reviews). A search on the databases' pre-defined search terms was also conducted and these were included in the group of final search terms. Furthermore, a search for grey (non-peer-reviewed) literature – such as dissertations, theses, ongoing trials, and other online scientific documents – was performed using the web search engine Google Scholar. In addition, a manual search was performed based on reference lists [117] and bibliographies of included articles and reviews. Languages were restricted to English and Danish. The literature search was supervised by experienced research librarians [177, 179]. For a full search protocol, please see Supplementary file Paper III, Appendix F [3].

Stage three: selection of relevant studies:

The identified studies were transferred to the reference software Endnote X9 [180], where duplicates were excluded. Based on inspections of the titles and abstracts, studies were categorized as "potentially relevant" or "irrelevant" [180]. References deemed "potentially relevant" were obtained as full text. The final selection of studies was based on careful scrutiny of the full-text papers in relation to the specified relevance criteria, as recommended by the guidelines for scoping reviews [174]. The initial assessments of titles and abstracts were performed by the author, and final selection was performed by the author and co-supervisor Jan Sørensen and discrepancies were resolved through discussions to reach consensus [181].

Stage four: charting data:

Included studies were assessed to identify relevant cost variables for bed bath methods. To categorize the studies and extract the data, two standardized charting forms were developed [174]. The content of the charting forms was discussed with all supervisors and adapted to augment the quality.

The first charting form displayed the demographic data of the included studies. It included 11 characteristics, as shown in detail in Table, 2 Paper III, Appendix F [3]. The characteristics are summarized in Table 12, in section 6.3. The mean costs were reported as they appeared in the papers and were converted to 2018 US$ using the mid-year currency rate for the reported year and relevant price indices, to account for inflation and price changes [182].

The second charting form categorized the resource items based on the activity-based costing (ABC) method as described by J. Beecham [183-185] and A. Donabedian's model [186-188].

ABC costing is an appropriate method to use in connection with a relatively well-defined procedure, such as a bed bath. This framework breaks down an intervention (here seen as the bed bath) into individual activities and makes it possible to assess and value them, first separately and then collectively [183-185]. A cost analysis can be seen as identification of relevant resources involved in a bed bath (running and capital costs), assessment of

resources used, and aggregation of costs of the resources used [183, 189, 190]. This method measures actual use of identified resource items (e.g., staff time and consumables) and their values in monetary terms. Running costs covered staff time spent, equipment, including waste and its management, electricity, water, and sewage. The staff time should include a "load factor", which describes the ratio of maximum worktime per staff (e.g., 1,924 hours per year) and mean time spent (observed) with patients care (e.g., 1,400 hours per year) [183]. Capital costs, including machinery and buildings used for bed baths, were represented by the decontaminator for washing basins, microwave for heating DWW and washing basins. Investment, service life, service and activity were seen as equivalent annual cost (EAC) [189, 190].

Donabedian's model, including structure, process, and outcome of a procedure [186-188] was applied, to identify relevant factors that influence the cost of a bed bath. The model is linear and assumes that the structure (in this context the resources used for a bed bath, including the staff time used, and the equipment and machinery needed to perform the bed bath, e.g., microwave and decontaminator) influences the process.

This affects outcomes, which are regarded as positive and negative consequences of employing different washing methods, such as infections, skin impact, prolonged hospitalization, as well as patients' satisfaction and well-being. In addition, the term 'outcome' also includes appropriate use of resources, staff satisfaction, and a good working environment.

Chapter 6. Findings and results

In this chapter, findings and results are presented in relation to sub-study I, II and III. The descriptions provide an overview based on the published papers in Appendix F [1-3], with additional supplementary elaboration. Specifically for sub-study II, it includes a summary of characteristics of participants, additional findings, and a summary of the findings. A summary of the included studies in the scoping review in sub-study III is also included.

6.1 Sub-study I

Results

Out of 284 potentially eligible patients, 72 participants were included in the study during dayshifts, between November 2016 and February 2018. In total, 130 skin swabs were obtained (58 paired samples and 14 single samples). The inclusion and exclusion process is illustrated in Figure 2, reproduced from [1].

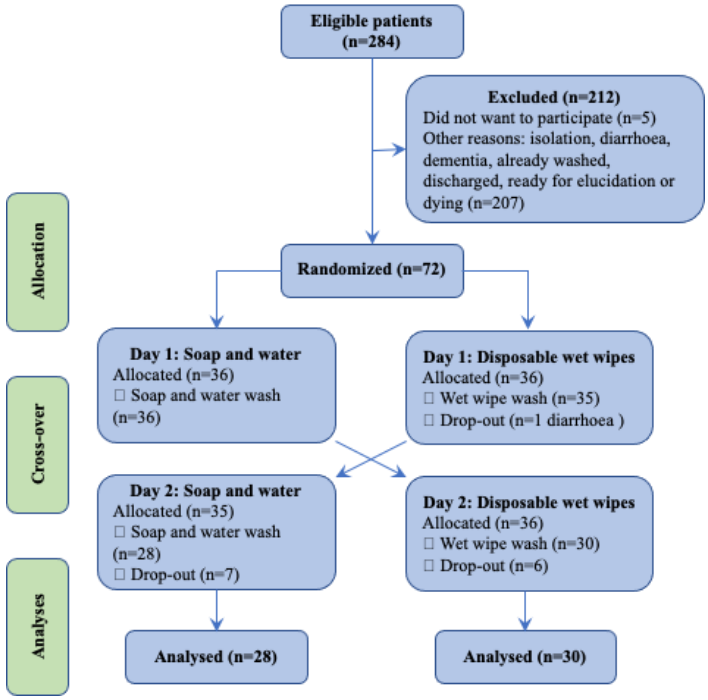

Figure 2: Flowchart illustrating the inclusion and exclusion process in sub-study I [1]

In the study, 31 of the 58 participants with paired samples (54%) were washed by the same nurse on both days. The rest of the participants were washed by different nurses on day one and day two. Five patients who met the inclusion criteria declined to participate, and 14 patients dropped out (19%) because they got diarrhoea (n=6), moved to isolation (n=2), received topical treatment (n=1), were discharged (n=3) or had already been washed before intervention on day two (n=2). The characteristics of the study participants are shown in Table 7, reproduced from Paper I [1].

Table 7: Demographic and medical characteristics[1] of study participants [1]

Variable	All n=72	Paired n=58	UTI[6] n=70	E. Coli[7] n=36
Female/male	35/37	28/30	34/36	18/18
Median age (range)[2]	76(38-98)	77(38-96)	77(38-98)	77(43-98)
Median length of stay in days (range)[3]	5(1-93)	6(1-79)	6(1-93)	5(1-93)
Diabetes	27(38%)	23(40%)	27(38%)	33(30%)
Urinary catheter	49(68%)	38(66%)	49(68%)	25(69%)
Diaper	65(90%)	52(90%)	65(90%)	33(91%)
Wound	29(40%)	27(47%)	29(40%)	14(39%)
Stoma	11(15%)	11(17%)	11(15%)	6(16%)
Skin problems	21(29%)	20(35%)	21(29%)	11(31%)
Surgery	19(26%)	17(29%)	19(26%)	9(25%)
Diagnosis[4]				
Elucidation	12(17%)	9(16%)	12(17%)	8(22%)
Infection	17(24%)	13(22%)	17(24%)	6(17%)
Cancer	6(8%)	4(7%)	6(8%)	1(3%)
Surgical	9(13%)	9(16%)	9(13%)	6(17%)
Medical	16(22%)	14(24%)	16(22%)	9(25%)
Other	12(17%)	9(16%)	12(17%)	6(17%)
Antibiotics				
In treatment[8]	27(38%)	22(38%)	27(38%)	14(36%)
Length of treatment (days)[5]	4.3(1-11)	4.2(1-7)	4.3(1-11)	4.7(2-11)
Broad-spectrum antibiotics	8(30%)	5(23%)	8(30%)	6(43%)

[1]Characteristics reported in numbers of participants included and divided by each subgroup.
[2]Age is reported in years.
[3]Length of stay is reported in days.
[4]Diagnosis reflects the reason for the actual admission.
[5]Broad-spectrum antibiotics are Tazobactam and Piperacillin.
[6]Participants with microbes that could potentially cause urinary tract infection.
[7]Participants with *E.* coli
[8]Treated with antibiotics while obtaining swabs

Microorganism species

In total, 42 different MO species were identified before and after washing with either SAW or DWW. Of these, 22 were determined as potentially causing HAUTI [1].

For paired data, the number of MO species identified on a participant (from both days and groin and perineum) varied from 3 to 8. On average, the participants had 5.5 MO species in the groin and perineum. The most common MO species were: *E. faecalis*, identified 226 times (16%), *S. epidermis* identified 215 times (15%), *E. faecum* identified 183 times (13%), *S. haemolyticus* identified 178 times (12%) and *E. coli* identified 141 times (10%) [1].

Table 8, reproduced from paper 1 [1], shows the total number of MO species and amounts of MOs for all participants. Contamination with new species of MOs was observed after washing with either method. For paired data, the number of MO species increased from 320 to 329 (2.8% contamination) after washing with SAW, and from 317 to 329 (3.7% contamination) after washing with DWW. The analysis of MO species that could potentially cause UTI showed that the number of these MO species increased from 316 to 339 (7%) in the swab samples after washing with SAW, and from 279 to 291 (4%) after washing with DWW. The number of *E.* coli increased from 38 to 44 (16%) after washing with SAW, and from 28 to 31(11%) after washing with DWW.

Amounts of microorganisms – the primary results

For paired data, the amounts of MOs decreased in all the swab samples after washing with SAW, from 615 to 503 (18% reduction) and, after washing with DWW from 579 to 480 (17% reduction). There was no statistically significant difference ($p=0.84$) in the reduction of the amounts of MOs between SAW and DWW. No statistically significant difference was found between SAW and DWW when testing for carry-over effect (i.e. whether the order of the washing method had an impact on the result) [1].

Table 8: Total number of species of MOs and amounts before and after washing with soap and water or disposable wet wipes [1]

	SAW[8] Before	After	Delta[5]	n[4]	**DWW[9]** Before	After	Delta[5]	n[4]
Total[1]								
Number of MO[2]	320	329	410	58	317	329	376	58
Amounts of MO[3]	615	503	410	58	579	480	376	58
Groin								
Number of MO	158	158	198	58	158	163	184	58
Amounts of MO	302	235	198	58	292	236	184	58
Perineum								
Number of MO	162	171	212	58	159	166	192	58
Amounts of MO	313	268	212	58	287	244	192	58
UTI[6]								
Number of MO	316	339	410	70	279	291	336	60
Amounts of MO	603	522	410	70	504	424	336	60
E. coli[7]								
Number	38	44	50	34	28	31	33	24
Amounts	60	55	50	34	39	34	33	24

[1] Values for paired samples
[2] The number of species of MOs present on the skin
[3] Amounts of all MOs from all species of MOs (sum of value 1, 2 or 3 ordinal scale)
[4] Number of participants
[5] The number of deltas is higher than number of MOs before and after, because some amounts of species of MOs are 0 before and after and will be counted as a delta value
[6] Amounts of 22 identified species of MOs potentially causing urinary tract infection and used for statistical analysis
[7] Identified *E*. coli used for statistical analysis
[8] Soap and water
[9] Disposable wet wipes

Amounts of microorganisms – Secondary results

The secondary descriptive analysis of the paired data showed that the reduction in amounts of MOs ranged from 1 to 13 and the increase ranged from 1 to 5 after washing with either SAW or DWW. The increase and decrease in amounts of MOs are presented in Table 9, reproduced from Paper I [1].

A total of 36 out of 58 (67%) participants had a reduction in amounts of MOs after washing with SAW, compared to 39 out of 58 (69%) after washing with DWW. An increase in the amounts of MOs was seen in 11 out of 58 (19%) participants after washing with SAW and in 13 out of 58 (21%) after washing with DWW. The analysis showed that the reduction in amounts of MOs after washing with both SAW ($p=0.0001$) and DWW ($p=0.0148$) was statistically significant.

Table 9: Change in amounts of MOs after washing with soap and water or disposable wet wipes [1]

Aomunts of MOs[0]	**SAW[5]**	**DWW[6]**
Increase:	19%[3]	21%[3]
5	0	1
4	2	0
3	1	3
2	2	6
1	6	3
Same:	14%[4]	10%[4]
0	8	6
Reduction:	67%[5]	69%[5]
1	13	11
2	10	10
3	5	7
4	1	4
5	2	2
6	2	0
7	0	2
8	2	1
9	2	0
10	0	1
11	1	0
12	0	1
13	1	0
Mean before[6]	10,6	10,0
Mean after[6]	8,7	8,3
P (value)	0.0001	0.0148

[0]MOs – Microorganisms
[1]SAW – soap and water
[2]DWW – disposable wet wipes
[3]Percent of participants which increase after washing (1-5)
[4]Percent of participants with no effect from interventions (0)
[5]Percent of participants which reduction after intervention (1-13)
[6]58 participants

The analysis of the paired data showed that the amounts of MOs in the groin were reduced from 302 to 235 after washing with SAW (22% reduction) and from 292 to 236 for DWW (23% reduction). In the perineum, a reduction was found in the amounts of MOs from 313 to 268 (14% reduction) after washing with SAW and from 287 to 244 (15% reduction) after washing with DWW (Table 8) [1]. There was no statistically significant difference in the reduction of amounts of MOs between groin and perineum for either SAW (p=0.65) or DWW (p=0.15) or in the reduction of the amounts of MOs between SAW and DWW for either groin (p=0.97) or perineum (p=0.51).

For MOs that could potentially cause HAUTI, the analysis showed a significant reduction in amounts of these MOs after washing with SAW (from 603 to 522, p=0.0008), and also after washing with DWW (from 504 to 424, p=0.0001). However, there was no statistically significant difference (p=0.70) in the reduction of amounts of MOs between SAW and DWW for MOs that could potentially cause HAUTI [1].

For *E*. coli, the analysis did not show a statistically significant reduction after washing with SAW (p=0.48) or after washing with DWW (p=0.28). Furthermore, no statistically significant difference (p=0.57) was seen in the reduction of the amounts of MOs between SAW and DWW for *E*. coli [1].

6.2 Sub-study II

Findings

Sixteen in-depth, individual, semi-structured interviews were conducted, from October 2016 to May 2017 with bedridden patients from the three wards. Two patients who met the inclusion criteria declined participation. Characteristics for the included participants are summarized in Table 10.

Table 10: Characteristics of participants, sub-study II

Age in years (mean/range)	67 (43-81)
Gender (male/female)	5/11
Length of stay in days (mean/range)	8 (2-35)
Interview in minutes (mean/range)	23 (17-41)
Marital status (# patients)	Single (9) Cohabitant (7)
Connection to the labour market (# patients)	Retired (10) Link to work (6)
Ward (# patients)	Surgical (8) Medical (4) Emergency (4)
Occupational background (# patients)	Health professional (5) Communications (2) Vocational (9)
Diagnosis (# patients)	Infection (4) Chronic diseases (7) Elucidation (5)
Other variables (# patients)	Stoma (5) Diaper (10) Urinary catheter (9) Skin issues (3) Assessed by staff as bariatric (2)

Table 11: Summary of findings of sub-study II

Creating a sense of cleanliness	**A general preference for the use of SAW, if given a choice** SAW led to a feeling of being "really washed" SAW was described as the type of bath that removed bacteria, dirt and sweat from the skin much more effectively than DWW SAW gave a feeling of cleanliness Some did not feel clean or found they did not smell clean after using DWW, whereas others felt clean and appreciated the advantages of using DWW Wet skin for a long time with DWW was associated with feelings of not being clean
Preferences and concerns in different situations	**Washing with DWW was described as freshening up** Some expressed very clearly that they did not like to be washed with DWW It was convenient and faster to use DWW if they had pain or diarrhoea Being washed with DWW was preferred to no bathing at all Some pointed out that DWW was faster for the staff to use
Cleanliness of hands and face	**The need to use SAW was extremely important when it came to the hands** **Washing the face was special and water on its own was preferred** Most wanted their hands to be "really clean" by using SAW Needs and preferences for these two body parts were different from the rest of the body As hands touch everything in the environment and are used to put food into the mouth, SAW for the hands was preferred Needed to wash their hands with SAW at least once a day and always after using the toilet Most did not want soap on their face Most did not like their face to be washed with DWW
Clinical decision-making about bed bath method	**The opportunity to have a bed bath was more important than whether it was performed with SAW or DWW** A few were offered a choice of washing method Strong acceptance of the nursing staff's decisions – that the staff did it in their own way and decided what they found suitable in the situation Some did not think it was possible to choose SAW while they were bedridden Some wanted a shared decision, depending on whether they were bedridden, had pain, the length of stay and how it fitted the situation A few would like the staff to ask them what their bed bath preferences were

Additional findings

Having a shower almost every day was the overall preferred method for personal hygiene, and cleanliness was considered necessary and essential for well-being and self-esteem. Furthermore, it was extremely important to the participants to smell nice. Otherwise, they would feel disgusting and ashamed. The quality of the wipes and how fast and easy they were to use, softness of the wipes and the fact that they did not need to apply lotion after washing were appreciated, compared to washing with SAW. The wipes were characterized as big, soft, moist, and pleasant, but the participants also felt the DWW left a layer on the skin, which they expressed as "oily" or "a film". Other participants associated use of DWW with redness, irritation, dryness, scaling and itching of the skin, which they related to recent skin problems, such as eczema or flaking skin.

6.3 Sub-study III

Results

A total of 1,588 studies were identified after duplicates were removed. Figure 3, reproduced from Paper III [3], shows the screening process leading to the final inclusion of nine studies.

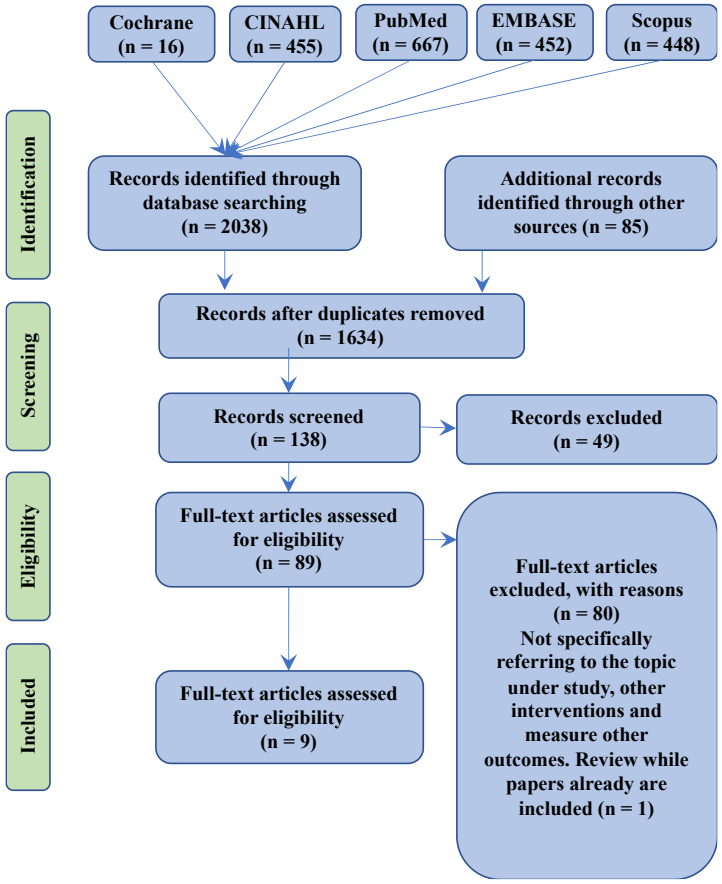

Figure 3: Result of the screening process, sub-study III [3]

Demographic data

Demographic data and characteristics related to the nine included studies are presented in Table 2 in Paper III Appendix F [3]. Table 12 presents a summary of these.

Table 12: Summary of characteristics of the included studies in sub-study III

Publication/year (range)	1995 - 2017
Country	Australia: 1 [80] Denmark: 1 [28] Netherlands: 1 [18] Turkey: 1 [19] USA: 5 [13, 14, 31, 95, 104]
Duration of the studies in days (range)	3 days – 18 months
Unit of analyses	One bath: 7 [13, 14, 19, 28, 31, 80, 104] Bath weeks/month: 2 [18, 95]
Setting	Hospital: 6 [13, 14, 19, 28, 31, 80] Nursing homes: 1 [18] Other settings: 2 [95, 104]
Wards	Medical/medicine: 6 Surgical/surgery: 6 Intensive care unit: 3 Other: 4
The data collection method used	Self-reported: 2 [19] Observations: 4 [14, 18, 28] Experts: 2 [19] Not applicable: 3 [31, 95, 104]
Bed bath method	Bath towel: 2 [80, 95] Wash gloves: 1 [18] Disposable wet wipes: 6 [13, 14, 19, 28, 31, 104]
Study design	Cluster randomized trial: 1 [18] Controlled randomized cross-over design: 2 [14, 28] Case study: 1 [95] Quasi-experimental: 1 [104] Quasi-qualitative: 1 [19] Questionnaires: 3 [13, 31, 80]
Time for bed bath (minutes)	SAW: 9-36 Other bed bath methods: 7-29

Resource variables

Variables reported for running and capital costs, and consequences in the included studies are shown in Table 13, parts of which are reproduced from Paper III [3], and summarized in the last column of the table.

Table 13: Resource variables of bed bath methods, sub-study III [3]

Studies Structure(X/O)[1]	Carruth 1995	Wright 1996	Hancock 2000	Larson 2004	Kron-Chalupa 2006	McGuckin 2008	Nøddeskou 2014	Shoonhoven 2014	Buyukyilmaz 2017	Summarized
Running cost	X	X	X	X	X	X	X	X	X	9
Staff time	X	X	X	X	X		X	X	X	8
Load factor[9]										0
Consumables[2]	X	X	X	X	X	X	X	X	X	9
Waste			O						O	2
Laundry service	X	X	X	X	X			X		6
Electricity[3]			O	O			O		O	4
Water			X	O		O		O	O	5
Sewage				O						1
Capital cost	X	X		X	X	X	O	O		7
Microwave/ decontaminator EAC[8]	O	O					O			3
										0
Basin	X	X		X	X	X	O	O		7
EAC[8]										0
Buildings[10]										0
EAC[8]										0
Consequences	X	X	X	X	X	X	X	X	X	9
Infection/ HAI[4]/ UTI[5]/LOS[6]						X				1
Basins harbouring MOs[7]	O	O		O		O				4
Skin impact	O	X	X		X			X	X	6
Patients	X	X	X		X		X	X	X	7
Staff	O	X	X	X	X		X	X	X	8

[1]X = present and measured, O= present and not measured.
[2]Consumables, including supplies and equipment.
[3]Electricity, including heating.
[4]Hospital acquired infection (HAI).
[5]Urinary tract infection (UTI).
[6]Length of stay (LOS).
[7]Microorganisms (MOs).
[8]Equivalent annual cost (EAC), including investment, lifetime, service, and activity.
[9]Load factor or overload, calculated as ratio work hours.
[10]Buildings, including facilities, rooms, installation, and storage.

Primary results

Eight of the studies included and measured staff time, but there were methodological differences in the costing assessments. In most of the studies, it seems to take less time for the staff to use DWW than SAW. All studies included costs of direct staff time used without any uplifting to a load factor. None of the studies included service cost or EAC of capital cost, including investment, lifetime, service, and activity for buildings, basins, or microwaves. No studies considered the cost of extra building space related to storage of washing equipment. Furthermore, none of the studies considered environmental impact. All studies included some consequences, a majority with focus on patient and staff. Only one study focused on infections as a consequence, but in that study, other consequences for patients and staff were not included.

Chapter 7. Discussion

The overall aim of the thesis was to provide new insights into the use of SAW and DWW for bed bath, and thereby contribute to increased quality of CDM of bed bath practices for bedridden patients.

This chapter provides a discussion of the results and findings across all three sub-studies, the research process, methodology and methods used in each of the three sub-studies. In addition, the overall mixed methods research design is discussed.

7.1 Discussion of results and findings

In line with the mixed methods research design, the results from sub-study I, II and III are discussed through narrative weaving in relation to the overall aim, each other, and existing research.

7.1.1 Shared clinical decision-making regarding choice of washing method for bed bath

The choice of washing method for a bed bath is part of CDM and the involvement of the patients' wishes, needs, and preferences is crucial for it to become shared CDM [191, 192]. The model of shared CDM, as described by Elwyn et al. [191], includes choice talk (informing the patient they have a choice), option talk (informing the patient of the different options) and decision talk (to decide which intervention to choose). Patient involvement takes place at all three phases, but particularly in the decision talk.

The participants in sub-study II pointed out that the nursing staff did not always discuss with them how they would like to be washed and did not ask about their preferences and needs (choice talk – informing the patient they have a choice). The nursing staff washed in their way, in their pace. The participants expressed that it was understandable not to be involved, both due to their actual situation and because of an understanding of the workflow and that the staff also had other tasks to do. The participants might perceive the interviewer as a nursing staff member, and therefore be sparse with criticism which they might think could have implications for their further care. This may be the reason for the overall positive responses from the participants.

Sub-study II showed diversity in the degree to which the participants wanted to be involved in shared CDM. Many participants wanted to have the opportunity to choose whether they wanted to be involved in the decision or not. A systematic review by Chewning et al. [193] support these findings of diversity in degree to which patients wish to be involved. From 115 studies concerning shared CDM, they conclude that there has been a gradual increase in patients' involvement in decision-making since 2000, but a small group of patients still do not want to participate actively in decisions regarding their care. Our findings in sub-study II also showed that most patients would like to hear about and discuss the options, although they generally did not want to take the final decision. In addition, Florin et al. [194], concluded that patients over the age of 61 years and living alone, tend to be more passive in terms of shared CDM. This could help explain why some of the participants (mean age 67) in sub-study II were more passive and preferred the staff to make the final decision.

Florin et al. [194] also indicated that nursing staff tend to overestimate patients' desire for active involvement in shared CDM. Although the nurses in that study believed that patients would like to participate in shared CDM, they did not consistently actively include them in clinical decisions [194]. Other studies identified factors of significance in relation to the extent to which nursing staff involved patients in shared CDM [76, 195]. These included work pressure, lack of policy, knowledge, guidelines, lack of insight, continuity of patients (having the same patient over longer period) as well as attitudes, culture, and other tasks in the department [76, 195]. A systematic review from the Netherlands [21] supports this, by concluding that the nursing staff often decide which method to use for a bed bath without involving the patients in the decision. Findings from sub-study II also indicated that many of the participants accepted that the nursing staff made the final clinical decision, when they could see that the staff were busy and that it was time saving to use DWW. This may explain why the nursing staff did not even invite the patients to enter the choice phase in the shared CDM in sub-study II.

Elwyn et al. [191] describe the option phase in shared CDM as providing and discussing detailed information about the options in the actual situation. Hereby, the advantages and disadvantages for SAW and DWW identified in sub-study II and III, such as preferences,

time consumption, impact on the skin and self-care should be discussed with the patients, while identifying and addressing the patients' current needs.

The nursing staff should provide the necessary information to the patients according to the staff's own experiences and preferences for DWW in the given situation, together with the findings of patients' preferences for SAW from sub-study II. Furthermore, it is important to discuss with the patient whether they want to be freshened up or "really" washed in the actual situation – as elaborated in subsection 7.1.2.

It is also relevant and important for the nursing staff to know that there is no statistically significant difference between SAW or DWW in the effectiveness to reduce the amounts of MO on the skin after washing and that both washing methods provides a risk for contamination with new species of MOs. This evidence may help both the patients and nursing staff to choose the washing method that is most convenient and preferred in the specific situation.

The patients may become more independent and self-reliant when using DWW which could be important for the patients to know, as they can wash themselves when they want to, and they do not have to wait for the nursing staff. Sub-study III shows that time is saved by using DWW instead of SAW, which is supported by the findings from sub-study II. It was found to be of great importance for the patient if the choice is between not being washed at all during the day shift or being washed using DWW. There seems to be both advantages and disadvantages to the timesaving [7, 28, 30, 61, 104]. The shorter time spent may be less stressful for patients who are in pain. For the nursing staff, shorter time spent for washing can be more conducive to the workflow on an efficient and busy ward. However, timesaving could also make the bed bath more impersonal, and of lower quality. Also, bed baths are often used for dialog and observation for which there will be less time.

In addition, patients' preferences for washing the face and hands should be clarified and taken into account, given that sub-study II showed mixed findings regarding washing the face, and preferences for washing the hands at least once a day with SAW.

Thus, the final decision talk [191] refers to deciding together with the patient which washing method is considered the best in the current situation. This includes identifying,

balancing, and addressing the patient's current needs and preferences, and create a real option for the patient, regardless of the nursing staff's own preferences for DWW [14, 18, 28, 30, 54].

7.1.2 Freshening up or feeling really clean

The participants in sub-study II clearly preferred SAW for bed baths if they were visibly dirty, sweating, had body odours, and if they wanted to feel clean. The use of SAW led to a feeling of being "really washed" [2]. These findings are in contrast with previous survey studies, which showed that both patients and nursing staff predominantly preferred using DWW or similar products, rather than SAW [14, 18, 28-30, 54]. It is therefore important that nursing staff consider the patient's actual needs and preferences.

Findings from sub-study II also revealed that DWW was a very good opportunity to be freshened up, and the washing method was preferred in specific situations, if the patients had pain, diarrhoea or just needed a quick and easy bath. Furthermore, if washing with DWW was given as the only opportunity to be freshened up that day, this was preferred to not being washed at all [2]. These findings are in line with survey studies that also found DWW to be a quick and easy way to be washed, compared to SAW, for both patients and nursing staff [7, 28, 30, 61, 104]. On this point, there appeared to be agreement between the patients and nursing staff. The distinction between being washed clean with SAW and freshened up with DWW has also been identified in two international descriptive studies on bed bath procedures [54, 196].

Sub-study I showed no statistically significant differences in reducing the amounts of MO on the skin after washing, between SAW or DWW [1]. These results are in line with other studies [14, 20, 33]. However, this contrasts with findings in sub-study II, where participants expressed that SAW removed bacteria, dirt and sweat from the skin much better than DWW. In sub-study I, a significant reduction in amounts of MO was found, although contamination with new MO species was also found following either washing method [1]. Contamination with new MO species was also identified in other studies [14, 20, 33]. Although these results do not support the participants' experiences of being cleaner after washing with SAW compared to DWW, the experience of oily, sticky, or greasy layers on the skin after washing with DWW were still there and may support the

feeling of not being clean, which might stress the patients [93]. In line herewith, other studies point out that DWW may be less effective than SAW in certain situations, such as removing specific types of faeces [16, 19, 78]. Washing patients who have faeces incontinence can be difficult, as faeces contain fat and proteins which can make it difficult to wash it off with DWW, thus leaving bacteria on the skin [78]. Sub-study I did not find any significant statistical difference in the effect of washing methods on reducing the amounts of *E.* coli between SAW and DWW, and neither washing method significantly reduced the amounts of *E.* coli.

7.1.3 Cleanliness is essential in social relations

The participants in sub-study II had a general concern about body odours. It was extremely important to them to smell nice and clean. Generally, they wanted to smell of soap, otherwise, they felt disgusting and ashamed when they were together with other people and relatives. Furthermore, they believed that they would smell bad if they were not washed every day during hospitalization. If they were visibly dirty, were sweating and had body odours, they wanted to be washed with SAW rather than DWW. Especially after several days of washing with DWW, some participants experienced a bad smell. This bad smell following the use of DWW is well known [39, 196], and it is therefore important for the nursing staff to be aware of how many days the patient has been washed with DWW as part of the CDM.

The participants in sub-study II also described washing as a daily indispensable act that had an impact on integrity, self-image, personality, and well-being. Being washed and feeling clean were essential to their self-esteem and for them to be met with respect. Other studies are in line with this, pointing out that being washed is an important, meaningful activity related to well-being and is considered important for the person's self-image and dignity [25, 55, 75, 77, 198].

Historically, the purpose of performing personal hygiene and being clean seems to be related to being an upright and moral human being who fights dirt, MOs and impurities by following social codes of cleanliness, thereby remaining healthy and productive [6, 9, 10, 199-201]. These codes are reflected in our contemporary approach to cleanliness,

washing and baths, as part of our culture, and this probably affected the participants' need for personal hygiene in sub-study II.

In Western countries, cleanliness is a matter of social codex in relations [4, 10, 55, 201]. One must control body odour as it affects other people, and thus the smell can be perceived as an indecent assault on the integrity of others. We are not born with a sense of cleanliness, but as part of the civilization process, we are brought up to understand when, how, why, and how often to wash [9, 10, 56, 200, 202-204]. Norms and social codes of body washing are disseminated through upbringing, traditions, habits, knowledge, and politics, which are in line with in the findings in sub-study II [2]. The social codes can explain why some of the participants felt disgusting and ashamed if they smelled bad.

Body odours are generated in a chemical process between skin flora, sweat and environmental influence [201, 202, 205-209]. The skin has its own natural flora [206-209], and various bacteria, such as coryne bacteria (difteorides), are responsible for our body odour [205]. Thus, there is a physiological explanation for smelling if you sweat or simply have not washed for a while. In sub-study I, coryne bacteria was the sixth largest group of MO species. In a social group, the skin flora, and thereby the body odour, becomes common and therefore people generally cannot smell each other [201, 202]. This implies that, if you can smell another person, you are not likely to be part of the social group, and this is generally associated with a feeling of discomfort. Thus, mastering one's body odour, and body excretions so that others are not bothered by unpleasant smells and visible dirt is important for us [201].

Concerns about the use of DWW for hand hygiene was that something was left on the skin. One informant referred to this as obnoxious and unsanitary. Therefore, the participants primarily wanted to wash their hands with SAW at least once a day [2]. These specific findings regarding hands have not been identified in other studies. Special hygiene is associated with the hands and hand hygiene remains one of the most significant interventions in preventing infections [94]. It is notable that *E.* coli, klebsiella, pseudomonas and S. Aureus, found in sub-study I, are some of the MOs that often cause HAUTI and are often transmitted by the hands [94].

Hands are used for handshakes, eating, and touch across families, groups, and relations. Shaking hands is considered good etiquette in some cultures but, when shaking hands, you can potentially transfer dirt and MOs. This may clarify why the informants highlighted the cleanliness of their hands as something special, and that SAW should be used for the hands at least once a day. In Denmark, it is considered appropriate to meet patients' handwashing needs, according to recommendations for healthcare professionals, where SAW are always followed by hand sanitizer [94]. If there is visible dirt on the hands, handwashing with SAW must always be carried out first, otherwise hand sanitizer can be used alone. The fact that some participants in sub-study II were offered only DWW for handwashing for an entire day [2], may not comply with the national recommendations for handwashing in Denmark [94]. Also the participants preferences were SAW [2] and therefore, the nursing staff should consider also offering SAW for handwashing.

Post completion of the project, the world has seen a COVID pandemic which has altered the public understanding and importance of infection prevention through hand-hygiene, use of face masks, and keeping distance. It is now generally accepted not to abide to the previous etiquette of handshakes and hugs. The pandemic has caused an increased awareness of hand hygiene in the public, and therefore patients and nursing staff will enter into the CDM with that as a preunderstanding.

7.2 Methodological considerations

In this section, the strengths and limitations of the methodological considerations are discussed. The mixed methods approach and the singular methodology of sub-study I, II and III are discussed in relation to validity, reliability, and generalizability, as recommended [122, 123, 129, 142, 158, 210-214].

7.2.1. Mixed methods design

The strengths of choosing a mixed methods approach are the opportunity to respond to a broad and complex research aim [125, 126, 128], such as in this thesis. This approach led to a quantitative examination of effectiveness and costs of bed bath methods, and a qualitative exploration of patients' experiences and preferences of washing methods for

bed baths. Data from the three sub-studies were collected and analysed singularly and the results were merged within themes, in accordance with the mixed methods approach in the discussion. This has led to a new and deeper insight into washing methods for bed baths for bedridden hospitalized patients which is important in relation to CDM.

To accommodate the overall aim, quantitative and qualitative data were seen as equally important, and were treated as complementary. Quantitative approaches are associated with positivist or post-positivist epistemologies, while qualitative approaches are associated with constructionist or interpretative epistemologies [126, 215]. A conflict between the two paradigms of quantitative and qualitative research has been a hallmark in discussions of mixed methods [127, 128, 216]. Although there are distinctive differences between qualitative and quantitative research philosophies, they can be seen as potentially complementary sets of assumptions, concepts, and strategies, rather than two singular paradigms [129, 216]. In this thesis, pragmatism was applied as a third research paradigm, to accommodate the coexistence of the qualitative and quantitative research paradigms in the same research study [122, 127, 131]. Pragmatism does not solve all the challenges in using a mixed methods approach, and therefore strengths and limitations related to the mixed methods design are considered.

The multiple designs may be difficult for a single researcher to carry out, as it requires that one person must learn multiple methods [126, 131]. As a mixed methods researcher, it was necessary to be skilled in both qualitative and quantitative approaches, to be aware of the advantages and disadvantages of both methods [144], and to understand how to combine them appropriately [122, 126]. It is recommended that, as a minimum, the researcher should be acquainted with procedures for data collection and analysis of both methods [123]. Ahead of the PhD study, the student only had experience of qualitative research. Therefore, it was necessary and convenient that the supervisor team had multiple experiences [122], competences, and skills to supervise both the qualitative and the quantitative research methods and the content of the three sub-studies. Furthermore, the advantages of group dynamics helped bridge the various methodological traditions and made it easier to identify relevant components and themes across the studies for the discussion [123, 131]. Additional supervision was also given by statisticians for the

statistical analyses in sub-study I and by research librarians regarding the literature search in sub-study III.

In mixed methods, it is necessary to acknowledge the singular epistemology, methodology and distinctiveness of each sub-study. Thus, to accommodate this, the three sub-studies were conducted and published individually. Full development of each singular sub-study is beneficial for a more thorough final integration in the discussion of themes across the sub-studies [216]. Furthermore, confirmation of findings between the sub-studies may increase credibility and therefore provide stronger evidence for clinical practice [124, 126].

Integration (merging) is a hallmark in mixed methods research [124, 128], and it is an important aspect to consider. Integration was accomplished by explicit integration of the different stages in the sub-studies, as presented in Figure 1. In this thesis, data collection for sub-study I and II was linked through building [122, 124]. This subsequently led to an understanding of bed bath practices that was considered convenient and necessary for the development of the charting forms in sub-study III. The results of sub-study I, II and III were reported in separate papers, according to the staged approach. The process of integrating the findings of sub-study I, II and III at the interpretation and reporting levels was performed by using narrative weaving [124]. Weaving was beneficial for discussing qualitative and quantitative data together, theme by theme, in a unifying analysis, to answer the overall research question.

7.2.2 Sub-study I

The strength of the randomised cross-over design was that both washing methods were measured on the same patient and thus it only required half the number of participants, compared to a traditional RCT [145, 213]. For repeated measurements on the same person, the variation between the two data sets is reduced more than in a parallel design, and therefore internal stratification in relation to demographic variables was not required.

Block randomization was chosen to reduce selection bias and allocation balance over time, given that fewer than 100 patients were included [140, 148]. The block randomisation ensured that an equal number of patients were washed with SAW or DWW on the first

day during the randomisation period. A random block size could have further reduced the predictability of the allocation.

The inclusion period lasted 17 months, but it was only possible to achieve paired samples from 58 of the 62 patients recommended by the power calculation. Thus, there is a risk of type 2 errors, i.e., a false negative finding [141], for the main result, but in particular for the secondary analysis of *E.* coli.

The fact that the same person performed all skin swabs is presumed to reduce some of the bias, such as size of the skin area swabbed and pressure on the swabs.

Because it was easier to swab in the groin than in the perineum, due to the accessibility of the skin area, this may have induced a bias between results from the two swab areas; however, the sub-analysis did not show any difference between the two areas.

Since the wash-out period can be very different for individual participants [206-208, 217-219], the wash-out period and thus the potential carry-over effect must be considered as bias for the results in sub-study I [145]. The swabs were carried out during the day shifts, with an approximately 24-hour interval planned between the two different washing methods. There may be patients who had received intimate hygiene in the time between the two swabs that we do not know about. Patients with diapers (90% in this study) should have their diaper changed at least three times daily and, for every wet diaper, the patient should at least be washed with DWW [45]. How these patients had been washed the day before the first and second swabs may have affected the outcome of the swabs. These variations may have affected the validity of the results. The cross-over design reduced this bias and controlling for the sequence of washing with SAW and DWW in relation to the outcome showed no significant differences.

In total, 42 different MO species were identified on all the included patients, from both the groin and perineum. In addition, the patients had great individual variation, both in terms of number of MO species and amounts of MO. This may be caused by individual factors, such as their permanent MO flora [207, 208, 217] and whether they were in antibiotic treatment or not [219]. The random variation in MO species was a challenge in terms of being able to compare the reduction of MO between the two methods. Statistical

analyses were performed on the difference in amounts of MOs before and after washing. Other ways to analyse and present the results could have been chosen, e.g., log intervals, mean or median [14, 20, 64, 78].

It was not possible to blind the staff in relation to the washing methods, and the staff's preferences for either SAW or DWW may have affected how they washed the patient and thereby the outcome from the swabs. At the same time, the nursing staff might have been more careful with the washing procedure because the person who was going to perform the swabs stood and watched them (Hawthorne effect) [220]. In addition, that person was a teacher at the nursing school. Furthermore, DWW were sometimes warmed before use, but not each time; this may also have had an impact on the effectiveness in removing MO. Finally, the fact that only one brand of DWW was used, limits the generalizability of the results.

Despite guidelines for intimate hygiene, this procedure can be carried out in many ways due to differences of the patients, nursing staff, and surroundings. The oral discussions and verification of guidelines before and during the procedure are assumed to have contributed to increased consistency.

7.2.3 Sub-study II

The qualitative interviews attempted to explore hospitalized bedridden patients' experiences and preferences for washing with SAW and DWW. The semi-structured interviews contributed to a more in-depth and nuanced knowledge of how bedridden patients experience bed baths with the two washing methods. The main strength of the study was that it followed the seven stages for an interview, as described by Kvale and Brinkman [158]. This ensured important and necessary considerations for the entire interview process.

The maximum variation (heterogeneity) inclusion strategy helped elicit nuanced individual life-world descriptions of experiences using SAW and DWW [166]. Although the causal-felt method [167] were used to fulfil the maximum variations among participants, there may be variations that were not captured or covered sufficiently. With a requirement to be able to speak and understand Danish fluently, other ethnic minorities,

who could possibly have contributed with more nuances, were excluded. Furthermore, the reliability of findings for both genders can be questioned in relation to unequal inclusion of men and women.

Sixteen participants were interviewed in sub-study II. Sample size in interview studies is important to discuss and justify in relation to reliability of the findings [158, 221-225]. Malterud et al. [225] propose the model "Information power – Items and dimensions" to guide and estimate the final sample size. The sample size should be evaluated continuously during the research process to ascertain whether it is sufficient and varied enough to elucidate the aim of the study. According to the model, reflections about a narrow or broad study aim, dense or sparse sample specificity, the applied theory, a strong or weak dialogue, and the chosen analysis method, were used to determine the information power. In the current study, researcher experience from previous interview studies contributed to the establishment of positive relations and dialogue. Furthermore, the narrow study aim and inclusion of participants with various characteristics was convenient to get relevant and comprehensive information regarding the participants' experiences with washing methods for bed baths. Based on these considerations, the sample of 16 participants was considered sufficient to achieve new knowledge in relation to the aim of sub-study II.

An ongoing discussion is the requirement and possibility of accommodating epoche in phenomenological-hermeneutic research [161, 163]. It is debatable whether it is possible to set aside one's preconceptions in the analysis of the decontextualized conversations. It was not the intention to seek an absolute absence of pre-understanding, but rather a conscious, explicit, critical reflection regarding the importance of preconceptions [158]. The researcher's preconception was important for the construction of relevant interview questions [168]. Furthermore, the interviewer's female nursing background and previous work with intimate hygiene may have influenced validity in the analysis, and interpretation of the data [158, 223, 226].

Another important area to discuss is whether the findings in these qualitative interviews can be generalized [158, 166]. Patton [166] suggests reflection on transferability and fittingness (congruency between participants in this study and other patients), instead of

generalization, when dealing with qualitative findings. It is assumed that the findings to some degrees are transferable to other patients in different settings and contexts.

All interviews were completed in the wards and the interviewer wore uniform like the other nursing staff. It was pointed out that the interviewer was not a part of the nursing staff. Despite this stated independence, the participants may not have expressed potentially critical perspectives. In addition, the nursing staff who performed the bed baths may have had individual preferences towards the two washing methods, which may have influenced the participants' experiences of bed baths. It is also debatable whether a known discharge date could have influenced the participants' attitude towards DWW. An imminent discharge may have led to the hope of an upcoming shower and thus the present washing method could be unimportant.

In this study, only experiences related to the one specific brand of DWW used in the hospital have been studied. Other types may well feel different and thus lead to nuances in experiences, due to differences in ingredients and quality of the wipes.

7.2.4 Sub-study III

The main strength of the scoping review was that it followed the framework developed by H. Arksey and L. O'Malley [170] and the Preferred Reporting Items for Systematic Reviews and Meta-analysis for Scoping Reviews (PRISMA-ScR) guidelines [175]. Tricco et al. [175, 227] stress the importance of the use of a predefined protocol in scoping reviews. Protocols are often not reported a priori in scoping reviews [227]; however, a published protocol would have strengthened the methodological reliability of the scoping review in sub-study III, i.e. at the OSF registries [228].

A research librarian was involved at the earliest possible stage of the literature search, as recommended [177]. Still, the systematic search strategy may not have been exhaustive, for example due to linguistic barriers, chosen databases, or keywords selected.

Only a few studies of the studied that assessed washing with SAW and DWW included a cost analysis. Therefore, studies covering a broad selection of washing methods were included in the scoping review. This was considered relevant, as the aim was to identify

relevant variables, such as resources, time spent and consequences for the patients, to include in future cost minimization analysis [119, 120].

The cost analyses in the included studies were based on assumptions about resource consumption and unit costs. In addition, the included studies had a lack of transparency in the analysis units (patients, per bed bath or ward), time used and how unit costs were defined. Thereby, important, and relevant variables may not have been identified and captured, which may have affected the reliability of the charting forms.

Chapter 8. Conclusion

This PhD thesis provides new insights into using SAW and DWW for bed baths, which are essential elements in CDM for the nursing staff. The results and findings from the randomised cross-over study, the interview study, the scoping review, and the integrated mixed methods findings, lead to the following conclusions:

- There was no statistically significant difference in the effectiveness of SAW and DWW in the reduction of the amounts of MOs in the groin and perineum of hospitalized patients. After washing, new types of MO species appeared but with no difference between washing with SAW or DWW. The total number of MO species was significantly reduced, regardless of which washing method was used.

- Bedridden hospitalized patients preferred SAW for bed baths, as it gave them a sense of being clean. In specific situations, to freshen up or when in pain, washing with DWW was preferred. There were special requirements when washing face and hands. Hands should be washed at least once a day with SAW and water only was the preference for the face.

- Relevant running costs, capital costs and consequences in relation to washing methods were identified in the literature search. It is more expensive to use SAW than other washing methods, but the lack of transparency in the reviewed cost analyses makes it unclear as to whether there is a real difference in the cost between the two washing methods. The use of DWW frees up staff time, but it is uncertain how this time can be otherwise used, and the consequences there would be of spending less time on the patient.

Overall, the findings from the three sub-studies can be used to qualify CDM. Knowledge about efficiency of the washing methods and time consumption is essential in CDM, so that the nursing staff can make qualified, shared decisions with the patients. Hospitalized patients would like to have the opportunity to be involved in the clinical decision of the chosen washing method for bed baths; however, the opportunity to have a bed bath was

more important than whether it was performed with SAW or DWW. In coming to the clinical decision, the nursing staff must be aware whether the patient just wants to freshen up or prefers a more thorough wash. Being washed and feeling clean was a daily indispensable act for the patients. It had an impact on integrity, self-esteem, and well-being, and was essential in relation to dignity and respect in social relations.

Chapter 9. Future research and implications for clinical practice

9.1 Future research

The literature search identified survey studies which had quantitatively examined nursing staff's attitudes and experiences with DWW. During the data collection in sub-study II, the nursing staff at the departments expressed a desire to share their views on DWW. It would be interesting to explore the perspectives of the nursing staff on the use of SAW and DWW for bed baths, either through individual or focus group interviews. Observational studies on how the final clinical decision regarding washing method is made with the patients, could also provide important information on whether the decision is a shared decision and on factors that influence the decision.

It would also be relevant to develop a generic cost analysis that could be adapted and used in different care contexts. It might be appropriate to use a method developed for medical products [189, 190, 229], in which resources and time registrations are qualified and validated by experts. The generic cost analysis could then be tested in different settings and contexts, in collaboration with the nursing staff.

DWW is a cosmetic product that may contain allergenic ingredients. Studies point to a possible link between the use of DWW and the risk of fungus and intertrigo. Residue when using DWW needs to be investigated more closely. Such a study could be carried out, for example, in collaboration with established research environments in Belgium and Dublin, where the focus is on, among other things, the prevention of skin problems and pressure ulcers [16, 89, 230].

9.2 Implications for clinical practice

It is very important for hospitalized bedridden patients to be washed every day during admission. The results and findings from this thesis can help clinical nursing staff to come to a shared clinical decision with the patient, to decide which method to use. The findings encapsulate that the patients' feeling of cleanliness is important

to consider in the clinical decision, as it is important for the patients' quality of life during admissions. In addition, the nursing staff should be aware that the patients have varying preferences, depending on their actual situation. It is important for the nursing staff to:

- acknowledge that the most important factor is that patients have the opportunity to be washed every day, and that DWW should not be used many days in a row,
- identify the individual patients preference and when and how the patients wants to be involved in the clinical decision about washing method for bed baths and share the options with the patients,
- recognize situations where the patient just wants to be freshened up with DWW or when a more thorough wash is preferred with SAW,
- enhance the knowledge of advantages and disadvantages for using SAW and DWW in the clinical decision. This includes sharing nursing staff's knowledge and preferences with the patients,
- acknowledge the special requirements when washing face and hands and that having a shower is the patients first choice, whenever possible,
- be aware that the time gained by using DWW can be used for other activities and patients. Nursing staff must improve arguing towards management for why a bed bath should be performed with SAW if the patients prefer this. The longer time spent with the patient could be used to carry out in-depth observations of the skin and the patient's body, in relation to care, examination and treatment.

It is important that developers of standards and guidelines for bed baths practices:

- address the findings in this thesis in the development of new standards and guidelines for bed baths practices, and
- prepare a retrospective health technology assessment and a business case or a life cycle analysis on SAW and DWW in a context where

Danish procedures and materials are used and to include results and findings from sub-study I, II and III.

In addition, the literature search also identified articles in which methods other than SAW and DWW were used for bed baths. It seems that there are several advantages of those methods that could be interesting to explore further. Such studies could inform the development and renewal of traditional procedures, workflows, and utensils for bed baths. It would be ideal to discuss this issue with experts from different clinical practices.

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Appendices

A: Example of bed bath procedure

B: Search Strategy

C: Information material sub-study I (in Danish)

D: Information material sub-study II (in Danish)

E: Interview guide sub-study II (in Danish)

F: Paper I, II, III

Appendix A: Example of bed bath procedure

Bed bath and intimate hygiene	Soap and water	Disposable wet wipes
Utensils	Wash basin with water Disposable washcloths Towel for wiping Soap Clean, disposable medical gloves (for intimate hygiene)	Disposable wet wipes Clean, disposable medical gloves (for intimate hygiene)
Principles	Hand hygiene The soap is put on a wet disposable washcloth OR Soap is added to the water and clean water is used for rinsing All the soap must be rinsed off A fresh washcloth is used for each washing stroke The water is dabbed off with a clean towel.	Hand hygiene A new cloth is used for each washing stroke There is no need to dry the skin after washing.
Procedure/ instructions	First, wash the face, Then the upper body, arms and possibly the back, Then the lower body, legs, and feet. The back can be washed at the end when the patient is turned on the side Washing genitalia (There are often additional instructions for washing genitalia)	First, wash the face, Then the upper body, arms and possibly the back, Then the lower body, legs, and feet. The back can be washed at the end when the patient is turned on the side Washing genitalia (There are often additional instructions for washing genitalia)

References [18, 40, 44-47, 75].

Appendix B: Search Strategy

The search strategy was performed in the databases: CINAHL, Scopus and Pubmed, with relevant keywords, as described below and customized for each database.

Table showing generic keywords used in all the databases.

Generic Keywords in blocks
Genitalia OR meatal OR meatus OR perineal OR perineum OR periurethral OR (urinary catheter) OR penile OR skin OR body
Bath* ((travel bath) AND (prepackaged bath) AND (traditional bath) AND (Bag Bath) Care ((body care) AND (skin care)) wash* ((washing (waterless washing) AND (washing without water) AND (washing practices)) cleans* ((cleaned) AND (Cleaning)) wipe* ((disposable wet wipes) AND (wet wipe)) basin OR bowel OR towel OR washcloths OR (soap and water) hygiene ((intimate hygiene) AND (personal hygiene))
Experience OR Attitude OR View OR Perspective OR Feel OR opinion OR know OR understand OR Interview
(Counts on skin) OR (microbial load*) OR Microbes OR (skin flora) OR HAI OR nosocomial OR (skin flakes) OR (skin barrier function) OR (skin integrity) OR skin OR efficiency OR (colony count*)
Costs OR effectiveness OR evaluation OR economic OR money OR timesaving OR (time and motion)
Patient OR elderly OR bedbound OR homecare OR inpatient OR hospitalized OR bedridden OR aged care facilities OR admitted OR nursing homes OR primary health care

Table showing example of search strategy in CINAHL.

#	**CINAHL - keyword strategy**
1	Genitalia OR meatal OR meatus OR perineal OR perineum OR periurethral OR (urinary catheter) OR penile OR skin OR
2	Care OR washing OR waterless OR (travel bath) OR (prepackaged bath) OR traditional bath OR disposable OR washcloths OR basin OR bowl OR practices OR hygiene OR products OR without water OR alternative OR bath* OR wipe* OR towel OR wash* OR cleans* OR Cleaning OR cleaned OR (Bag Bath) (body care) OR (intimate hygiene) OR (personal hygiene)
3	TX Experience OR Attitude OR View OR Perspective OR Feel OR opinion OR know OR understand OR Intervie
4	TX (Counts on skin) OR (microbial load*) OR Microbes OR (skin flora) OR HAI OR nosocomial OR (skin flakes) OR (skin barrier function) OR (skin integrity) OR skin OR efficiency OR (colony count*)
5	TX Costs OR effectiveness OR evaluation OR economic OR money OR timesaving OR (time and motion)
4	#1 AND #2 AND #3
5	#1 AND #2 AND #4
6	#1 AND #2 AND #5
7	#4/#5/#6 AND Human
8	#4/#5/#6 AND Source type: academic journals

*Truncation, (TX) Search in full text

Appendix C: Information material sub-study I (in Danish)

Deltagerinformation om deltagelse i en videnskabelig undersøgelse

Jeg er sygeplejerske og er i gang med en videnskabelig undersøgelse.

Jeg vil undersøge, hvor godt to forskellige vaskemetoder fjerner bakterier på huden.

Vaskemetoderne er brug af vand og sæbe eller vaskeservietter. Formålet er at finde ud af hvilken metode der bedst fjerner bakterier på huden. For at finde ud af hvor mange bakterier der er på huden, kan man pode på huden. Dette gøres, ved at stryge hen over huden med en fugtig vatpind.

Jeg henvender mig derfor til dig for at spørge om jeg må pode dig to steder på huden. I lysken og ved mellemkødet. Podningerne vil være i forbindelse med, at du bliver vasket forneden.

Podningerne vil foregå over to dage. Den ene dag vil jeg pode dig før og efter du er blevet vasket med vand og sæbe. Den anden dag vil jeg pode dig før og efter du er blevet vasket med vaskeservietter. Det vil være tilfældigt, hvad der vaskes med den første dag.

Jeg vil desuden gerne have mulighed for at indhente oplysninger omkring din indlæggelse og om du får antibiotisk behandling. Det er frivilligt om du vil deltage i undersøgelsen. Selvom du har besluttet dig for at du gerne vil deltage, kan du altid vælge at træde ud. Du skal ikke komme med nogen forklaring på hvorfor du ikke vil være med. Dette gælder også selvom du har skrevet under på at deltage. Ved offentliggørelse af resultater sikres du fuld anonymitet.

Hvis du ikke vil deltage, vil det ikke få nogen indflydelse på din pleje og behandling.

Jeg håber at du har lyst til at deltage. Hvis du vælger at deltage, vil jeg anmode dig om at underskrive en samtykkeerklæring.

Med venlig hilsen

Pia Veje, Sygeplejerske, Phd studerende

Eventuelle spørgsmål kan rettes til Pia Veje

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Appendix D: Information material sub-study II (in Danish)

Deltagerinformation om deltagelse i en videnskabelig undersøgelse

Jeg er sygeplejerske og Ph.d.-studerende. I den forbindelse er jeg i gang med en videnskabelig undersøgelse.

Som en del af denne undersøgelse er jeg interesseret i nogle interviews om hvordan det opleves at blive vasket med vaskeservietter. Jeg henvender mig derfor til dig for at spørge om du vil deltage i et interview.

Interviewet vil rent praktisk foregå mens du er indlagt. Jeg vil komme og tale med dig i ca. en time. På et tidspunkt der passer dig. Interviewet bliver optaget på bånd.

Ved offentliggørelse af resultater sikres du anonymitet.

Det er frivilligt om du vil deltage i min undersøgelse. Selvom du har besluttet dig, for at du gerne vil deltage, kan du altid vælge at træde ud. Du skal ikke komme med nogen forklaring på, hvorfor du ikke vil være med. Dette gælder også selvom du har skrevet under på at ville deltage.

Hvis du ikke vil deltage, vil det ikke få nogen indflydelse på din pleje og behandling.

Jeg håber at du har lyst til at deltage. Hvis du vælger at deltage, vil jeg anmode dig om at underskrive en samtykkeerklæring.

Med venlig hilsen

Pia Veje, Sygeplejerske,

Phd studerende

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Appendix E: Interview guide sub-study II (in Danish)

Semistruktureret interviewguide **Hvordan oplever danske indlagte patienters brug af vand og sæbe og vaskeservietter ved sengebad i forhold til det at være ren og føle sig velsoigneret**	
Dato tid hvor skal interviewet foregå Afdeling Informant nr.	
Thematic dimension **Undersøgelsesspørgsmål / temaer**	**Dynamic dimension** **Interviewspørgsmål**
Briefing - Indledende spørgsmål Faktuelle data, Navn alder ægteskabelig status Indlæggelsesårsag og tidspunkt	Fortælle kort om denne undersøgelse Vil du præsentere dig selv
Tematiske dimension – generel hygiejne Hvordan får du opfyldt dit behov for personlig hygiejne; Hvilke forestillinger er der hos pt ifht det at være og føle sig ren; Hvad gør det nemmere at få denne hjælp	Vil du fortælle hvilken hjælp du får til at vaske dig selv Hvornår på dagen og af hvem - Hvordan klarer du vanligt dette Hvad betyder det at blive vasket for dig Hvordan vil du gerne have denne hjælp - Hvem vil du gerne have hjælper dig
Tematiske dimensioner -sengebad Hvordan opleves det at få hjælpe til Personlig pleje – sengebad – at blive vasket i sengen Hvilken betydning har komfort, velvære og livskvalitet; Hvilken betydning har renlighed, velsoigneret og velduftende	Vil du fortælle om sidste gang du fik hjælp til at blive vaske - i dag – til morgen Hvad bruges der til denne pleje og hvad er vigtigt for dig Hvad er vigtigt for dig ved at blive vasket Vil du fortælle om hvordan du har det bagefter Hvor ofte vil du gerne vaskes Hvem vil du gerne have vasker dig
Tematiske dimension-vand og sæbe Hvordan opleves et sengebad med brug af vand og sæbe - Hvordan har du det med sæbe Hvilke udfordringer er der ved denne pleje Hvad gør det nemmere	Hvornår er du sidst blevet vasket med vand og sæbe Vil du fortælle om hvordan det foregik Hvordan vil du helst have det foregår Hvordan føles det lige efter - Hvordan føles din hud Vil du fortælle om hvilken betydning det har at der bruges sæbe

<table>
<tr><td>Tematiske dimension – vaskeservietter
Hvordan opleves det at blive vasket med vaskeservietter - Hvordan har du det med vaskeservietterne - Hvilke udfordringer er der ved denne pleje - Hvordan har du det med disse servietter som en del af plejen</td><td colspan="4">Er du blevet vasket med vaskeservietter
Vil du fortælle om hvordan det foregik
Hvordan har du det mens personalet vasker dig med servietterne - Hvordan føles det - Hvordan føles det lige efter vask med vaskeservietter
Hvordan har du det lige efter - Hvordan føles din hud</td></tr>
<tr><td>Tematiske dimension - forskelle
Hvad opleves som bedst – hvad foretrækker patients' en
Fordele/ulemper ved de to metoder
Hvis der kun var vaskeservietter</td><td colspan="4">Hvis du kunne vælge om det skulle være vand og sæbe eller vaskeservietter? - Vil du fortælle hvorfor du vælger dette?
Hvornår vil du gerne vaskes med vaskeservietter?
Hvornår vil du gerne vaskes med vand og sæbe
Hvad tænker du om hvis der kun var vaskeservietter?</td></tr>
<tr><td>Tematiske dimensioner
Opsamling på svar</td><td colspan="4">Jeg vil gerne spørge om noget helt andet
Mener du at
Er det korrekt forstået at</td></tr>
<tr><td>Afsluttende spørgsmål
Debriefing</td><td colspan="4">Er der noget du vil tilføje
Er der noget som du ikke fik sagt
Er der noget vigtigt som vi ikke har talt om</td></tr>
<tr><td rowspan="6">Andet:
ID/ALDER
Diagnose(r):
Intro til vaskeservietter (år-sted-hvorfor):</td><td>Køn</td><td>Mand</td><td>kvinde</td><td>Uddannelse</td></tr>
<tr><td>Sår</td><td>JA</td><td>NEJ</td><td>Ægteskabelig status</td></tr>
<tr><td>Hudlidelser</td><td>JA</td><td>NEJ</td><td>Hvad er rutinen hjemme</td></tr>
<tr><td>Diarré</td><td>JA</td><td>NEJ</td><td>Frekvens</td></tr>
<tr><td>Anvender dagligt ble</td><td>JA</td><td>NEJ</td><td>Liggedage</td></tr>
<tr><td>Stomi</td><td>JA</td><td>NEJ</td><td>Andet:</td></tr>
</table>

References: [4, 158, 168]

Appendix F: Paper I, II, III

American Journal of Infection Control 48 (2020) 638–643

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Effectiveness of two bed bath methods in removing microorganisms from hospitalized patients: A prospective randomized crossover study

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Key Words:
Meatal care
Microbes
Disposable wet wipes
Soap and water
Urinary tract infection

Background: Few studies have compared the effectiveness of washing with either soap and water or disposable wet wipes. The objective of this study was to compare the effectiveness of washing with either soap and water or disposable wet wipes in reducing microorganisms in the groin and perineum of hospitalized patients, which could potentially reduce the risk of hospital-acquired urinary tract infections.

Methods: In this crossover, block-randomized trial, skin swabs from the groin and perineum areas of patients were obtained before and after these areas were washed with either soap and water or disposable wet wipes. Columbia agar plates and CHROMagar Orientation Medium (Becton Dickinson; Franklin Lakes, NJ) and matrix-assisted laser desorption/ionization time-of-flight mass spectrometry procedures were used to identify species of microorganisms.

Results: Fifty-eight paired skin swabs were obtained. Both washing methods resulted in a statistically significant reduction in the amount of all microorganisms, including microorganisms with the potential to cause urinary tract infections. New species were observed after using both washing methods. No statistically significant difference in the removal of microorganisms was observed between the two washing methods.

Conclusions: The two washing methods appear to be equally efficient in removal of microorganisms in the groin and perineum areas, including microorganisms that potentially could cause hospital-acquired urinary tract infections.

BACKGROUND

Hospital-acquired urinary tract infections (HAUTIs) are among the most common hospital-acquired infections[1-3] and affect an estimated 15,000 to 20,000 patients per year in Danish hospitals.[3] It has been estimated that 15% to 25% of all somatic patients have indwelling catheters, which may account for up to 80% of all HAUTIs.[2,3] For patients with HAUTIs, discomfort, pain, and complications are frequent,[2-4] and HAUTIs may impose additional health care costs.[5]

The majority of HAUTIs are caused by pathogens from the urethral meatus and by patients' normal flora.[3,4] Many interventions are available to reduce the risk of HAUTIs,[1,3,4] including performing intimate hygiene.[2] Most guidelines for intimate hygiene for patients with indwelling catheters, including the national Danish guideline,

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Conflicts of interest: None to report.

Author contributions: P.L.V. collected all the data and takes full responsibility for the integrity of the data and the accuracy of the data analysis. P.L.V., C.S.J., J.S., M.C., and J.P. contributed to the study design; analysis and interpretation of the results; and drafting the manuscript and have all approved the final manuscript.

Funding/support: Unrestricted funding was provided by the University of Southern Denmark, the region of Southern Jutland, University College South Denmark, and Hospital of Southern Jutland, University Hospital South Denmark.

https://doi.org/10.1016/j.ajic.2019.10.011

recommend one daily intimate wash with soap and water (SAW) or disposable wet wipes (DWW).[1-3]

An American study on the use of bed baths for inpatients with indwelling catheters found that the SAW method was more frequently used than DWWs for intimate hygiene.[1] The choice is generally made by the nursing staff based on an individual patient's actual situation, time available on the ward, and the staff's personal preferences and experiences.[6]

In Danish hospitals, the use of SAW is increasingly being replaced by the use of DWWs.[7] DWWs may offer advantages over SAW; for example, the risk of contamination can be higher with the use of SAW than with DWWs because the bath basin may become contaminated during the washing process[8,9] and become a potential source of infection.[10] The use of DWWs may leave the patient's skin feeling softer and better moisturized than after washing with SAW.[11] DWWs have been shown to be associated with enhanced skin barrier function and reduced risk of skin impairment, dermatitis, and pressure ulcers.[12,13] In addition, the use of DWWs has been found to reduce staff time and save costs.[7,8]

Only 3 studies have compared the effectiveness of SAW and DWWs in reducing microorganisms (MOs) on the skin.[8,9,14] Two of these studies found that both types of bath were equally effective in reducing MOs.[8,14] The amount of MOs was reduced after the use of both SAW and DWWs,[8,9,14] but two of the studies found increased numbers of species, indicating new contamination after washing with SAW and DWWs.[8,14] With increased use of DWWs in Danish hospitals, it is relevant to compare the effectiveness of SAW and DWWs in reducing MOs. The objective of this study was to compare the effectiveness of SAW and DWWs in reducing MOs in the groin and perineum areas of hospitalized patients, thus also potentially reducing the risk of HAUTIs.

METHODS

Study design

A randomized, crossover design was used in this study. The two interventions were washing with DWWs or SAW. Washing with SAW was performed with soap (containing sodium laureth sulfate, disodium, laureth sulfosuccinate, sodium chloride, cocamide DEA, glycerin, malic acid, sodium benzoate, glycol distearate, sodium hydroxide, steareth-4), water, washcloths, basins, and towels. Washing with DWWs was performed using packaged disposable wet wipes. Each pack included eight individually wrapped wet wipes. The ingredients included water, glycerin, decyl glucoside, glucolactone, sodium benzoate, calcium gluconate, *Aloe barbadensis* extract, *Chamomilla* recutita extract, caprylic acid, capric triglyceride, and tocopnenyl acetate. The materials and tools used for both washing methods were standard for the hospital.

Participants were randomized to a random sequence of the two washing methods. Group A had intimate hygiene with SAW on day one and with DWW on day two; group B had intimate hygiene with DWWs on day one and with SAW on day two. Block randomization was accomplished using sequentially numbered, opaque, sealed envelopes that assigned participants to either group A or group B. The block size was four, which allowed for six possible combinations of the randomization.[15] The envelopes were prepared by an independent secretary.

Participants

Three wards (an intensive care unit, a medical ward, and a surgical ward) in a Danish university hospital were identified by the hospital purchasing manager as the wards with most frequent use of DWW. Prior to the recruitment of patients, meetings were held with the head nurses at each of these wards. Subsequently, oral and written information about the study was provided to the nursing staff. Furthermore, instructions for intimate hygiene in accordance with the hospital guidelines[16] were provided to the staff in advance of washing and were repeated during washing. The nursing staff identified eligible patients who needed help with intimate hygiene during the morning tasks and asked the patients for oral consent to hear more about the study. Oral and written information was provided to interested patients, and written consent was collected in accordance with the inclusion criteria (Table 1). Randomization of patients occurred immediately after inclusion.

Table 1
Selection criteria

Inclusion criteria	Exclusion criteria
Patients >18 y of age	Patients with diarrhea
Patients in need of help with intimate hygiene	Patients in isolation.
Patients hospitalized for a minimum of 2 consecutive days	Terminal patients
Patients able to understand oral and written information	Patients waiting for elucidation
Patients able to sign a written consent for the study	Patients already washed
	Patients did not want to participate

Data collection

Skin swabs from each participating patient were obtained before and after washing with SAW or DWWs from one side of the groin and the perineum. MOs from these skin sites may potentially cause HAUTIs,[3] and both sites are prone to MO growth.[3,8] The same side of the groin was used on both days, and the same person obtained all of the skin swabs using aseptic techniques with sterile equipment[16,17] in accordance with infection control guidelines at the hospital and hospital guidelines for skin swabs, transportation, and storage.[16] An area 3 cm × 3 cm was swabbed with a moist sterile cotton swab.[8] Each swab was placed in Stewarts' medium and transported to the Department of Clinical Microbiology at the study hospital. Blinded cultivation, inspection, and qualitative classical microbiological analyses were performed in accordance with regional guidelines.[16]

All swabs were cultured on Columbia III agar plates with 5% sheep's blood (Becton Dickinson; Franklin Lakes, NJ)[18] and incubated 20 to 24 hours in a 35°C-37°C aerobic atmosphere. The inoculated plates were assessed by counting colony-forming units (CFUs) and determining colony size and hemolytic reactions of the MOs present. The swabs were also cultured on CHROMagar Orientation Medium (Becton Dickinson), which is a non-selective medium for isolation, direct identification, differentiation, and enumeration of urinary tract pathogens and for presumptive identification of many other pathogens.[16,19] The culture was examined using guidelines for identification based on different colony colors. Finally, species of MOs were validated using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry.[16] Demographic and medical characteristics were obtained for all participants using medical records and researcher observations, as well as directly from the participants (Table 2).

Statistical analysis

Non-parametric tests were used based on assessment of the distribution of the data.[20] Statistical analyses were performed using Stata/IC 15.1 (StataCorp; College Station, TX). Significance level was set at 95% All identified MOs were included in the analysis. The

Table 2
Demographic and medical characteristics of study participants

Variable	All participants (N = 72)	Participants with paired data (N = 58)	Participants with microbes with the potential to cause urinary tract infections (N = 70)	Participants with *Escherichia coli* (N = 36)
Female/male, n	35/37	28/30	34/36	18/18
Age (y), median (range)	76 (38-98)	77 (38-96)	77 (38-98)	77 (43-98)
Length of stay (d), median (range)	5 (1-93)	6 (1-79)	6 (1-93)	5 (1-93)
Diabetes, n (%)	27 (38)	23 (40)	27 (38)	33 (30)
Urinary catheter, n (%)	49 (68)	38 (66)	49 (68)	25 (69)
Diaper, n (%)	65 (90)	52 (90)	65 (90)	33 (91)
Wound, n (%)	29 (40)	27 (47)	29 (40)	14 (39)
Stoma, n (%)	11 (15)	11 (17)	11 (15)	6 (16)
Skin problems, n (%)	21 (29)	20 (35)	21 (29)	11 (31)
Surgery, n (%)	19 (26)	17 (29)	19 (26)	9 (25)
Diagnosis, n (%)*				
Elucidation	12 (17)	9 (16)	12 (17)	8 (22)
Infection	17 (24)	13 (22)	17 (24)	6 (17)
Cancer	6 (8)	4 (7)	6 (8)	1 (3)
Surgical	9 (13)	9 (16)	9 (13)	6 (17)
Medical	16 (22)	14 (24)	16 (22)	9 (25)
Other	12 (17)	9 (16)	12 (17)	6 (17)
Antibiotics				
Treated, n (%)†	27 (38)	22 (38)	27 (38)	14 (36)
Length of treatment (d), median (range)	4.3 (1-11)	4.2 (1-7)	4.3 (1-11)	4.7 (2-11)
Broad-spectrum antibiotics, n (%)	8 (30)	5 (23)	8 (30)	6 (43)

*Diagnosis reflects the reason for the actual admission.
†Patients were being treated with antibiotics when swabs were obtained.

number of CFUs for each species of MO was categorized by qualitative assessment at the Department of Clinical Microbiology as few ($\leq 10^4$ CFUs), some (10^4-10^5 CFUs), or many ($\geq 10^5$ CFUs). For the statistical analysis, the category of "few" was assigned the value 1, "some" was assigned the value 2, and "many" was assigned the value 3 on an ordinal dimensionless scale. For each participant, the amounts of the different MOs were summarized before and after each washing method (Table 4). In the analysis, two variables were used: the amounts of MOs, represented as the sum of the ordinal scale, and the number of MO species present on the skin. If a MO species was identified only after washing, it was assigned 0 before washing. In the summarized paired analysis, the change in total amounts of MOs was recoded as 0 (same and increase) or 1 (decrease). The interaction (carryover effect)[21] between sequences (AB or BA) was included as a dependent variable in a logistic regression analysis.

For summarized MOs (paired data), the Wilcoxon matched-pairs signed-rank test[21] was used to analyze if a difference could be observed in the amount of all MO and for species that could potentially cause HAUTIs, between the use of SAW and DWWs, and after washing with SAW or DWWs. The 2-sample Wilcoxon rank-sum test (Mann-Whitney *U*-test) was used to analyze whether or not a difference could be observed between the use of SAW and the use of DWWs with regard to the amounts of *Escherichia coli*.

Power calculation

Before conducting the actual study, a pilot study was performed to calculate the appropriate sample size for comparing the two methods. The pilot study included 10 patients from two wards. The power calculation estimated that 62 participants would be needed to obtain a power of 80% and alpha value less than 5% to reject the null hypothesis that there would be no difference in the reduction of the amounts of MOs between washing with the use of SAW or DWWs. A difference of 1 on the ordinal scale was considered to be a minimal clinically important difference.

Ethical considerations

This study was performed according to the ethical guidelines for nursing research in the Nordic countries[22] and guidelines developed by the World Medical Association implemented by the Danish National Ethics Committee. The study was registered at ClinicalTrials.gov (NCT02984527; SDUSF-2015-65/RI-(205)). The local scientific ethics committee confirmed that formal ethical registration and approval were not required. The head physicians at the 3 participating wards approved the study. Formal permission to store the data was obtained by the Danish Data Protection Agency (J.No.18/35356).

RESULTS

Out of 284 potentially eligible patients, 72 participants were included in the study during dayshifts between November 2016 and February 2018. In total, 130 skin swabs were obtained (58 paired samples and 14 single samples). The same staff washed on both days in 31 out of 58 patients. The characteristics of the study participants are shown in Table 2. Five participants who met the inclusion criteria declined to participate, and 14 patients dropped out because they got diarrhea (n = 6), became isolated (n = 2), received topical treatment (n = 1), were discharged (n = 3), or had already been washed before intervention on day 2 (n = 2). The dropout rate was 20%. Those who dropped out used a urinary catheter more frequently (n = 11; 79%) and were more often treated with antibiotics (n = 6; 43%), including broad-spectrum antibiotics (n = 3; 21%) than those who completed the study (Fig 1). No statistically significant difference was found between group A and group B when testing for carryover effect. In total, 42 different species of MOs were identified before and after washing.

For paired data, the number of species of MOs identified (from both days and skin sites) on a participant varied from 3 to 8. On average, the participants had 5.5 species of MOs on the skin. Contamination with new species of MOs after washing was observed after both washing methods. For paired data, the number of species of MOs

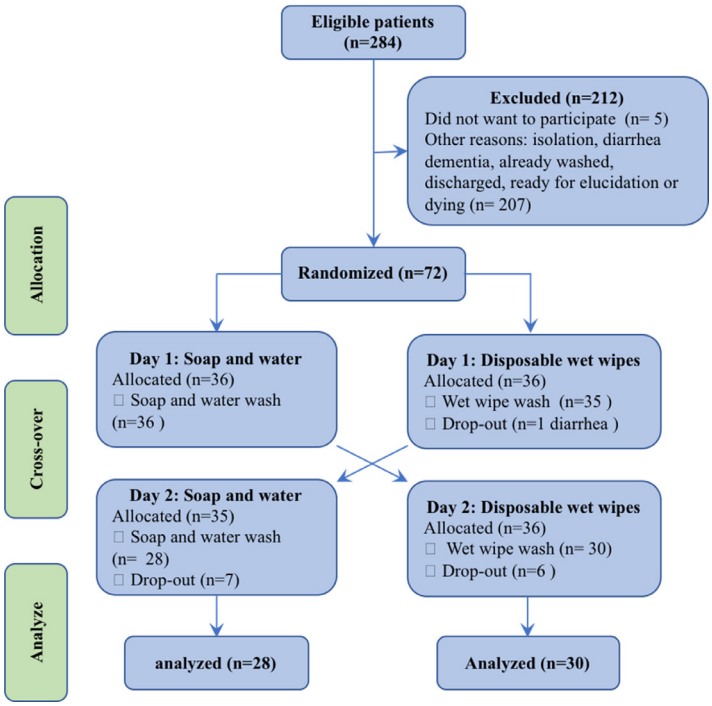

Fig 1. Flow chart.

increased from 320 to 329 in all of the swab samples after washing with SAW and from 317 to 329 after washing with DWWs. However, in the paired analysis, the amounts of MOs (1, 2, or 3 on an ordinal scale) in all of the swap samples decreased from 615 to 503 after washing with SAW and from 579 to 480 after washing with DWWs (Table 3). A sensitivity analysis of the paired swab samples collected in the groin showed a decrease in the amounts of MOs from 302 to 235 after washing with SAW and from 292 to 236 after the use of DWWs. In the perineum, a decrease from 313 to 268 was observed in the amounts of MOs after washing with SAW and from 287 to 244 after washing with DWWs.

The analysis for paired data showed that the summarized amounts of MOs were reduced 1 to 13 after washing with SAW and 1 to 12 after washing with DWWs for some participants. For other participants, the amounts of MOs increased 1 to 4 after washing with SAW and 1 to 5 after washing with DWWs (Table 4). Reductions in

Table 3
Total number and amount of microbe species before and after washing with soap and water or disposable wet wipes

	Soap and water				Disposable wet wipes			
Number and amount of microbe species	Before	After	Paired*	n†	Before	After	Paired*	n†
Total microbes								
Number of microbe species‡	320	329	410	58	317	329	376	58
Amount of microbes§	615	503	410	58	579	480	376	58
Microbes in the groin								
Number of microbe species‡	158	158	198	58	158	163	184	58
Amount of microbes§	302	235	198	58	292	236	184	58
Microbes in the perineum								
Number of microbe species‡	162	171	212	58	159	166	192	58
Amount of microbes§	313	268	212	58	287	244	192	58
Microbes potentially causing urinary tract infections‖								
Number of microbe species‡	316	339	410	70	279	291	336	60
Amount of microbes§	603	522	410	70	504	424	336	60
E coli¶								
Number of *E coli*‡	38	44	50	34	28	31	33	24
Amount of *E coli*§	60	55	50	34	39	34	33	24

*The number of paired microbes is higher than the number of microbes before and after because some of the species of microbes were 0 before and after.
†Number of participants
‡How many times the species of microbes were present on the skin.
§Amount of microbes (summarized as 1, 2, or 3 on an ordinal scale).
‖Amount of the 22 identified species of microbes with the potential to cause urinary tract infections and used for statistical analysis.
¶Identified *Escherichia coli* used for statistical analysis.

Table 4
Change in summarized amount of microbes after washing with soap and water or disposable wet wipes

Amount of microbes	Soap and water (N=58)	Disposable wet wipes (N=58)
Increase	19%*	22%*
5	0	1
4	2	0
3	1	3
2	2	6
1	6	3
Same†	14%†	10%†
0	8	6
Reduction, total	67%‡	67%‡
1	13	11
2	10	10
3	5	7
4	1	4
5	2	2
6	2	0
7	0	2
8	2	1
9	2	0
10	0	1
11	1	0
12	0	1
13	1	0
Means (summarized MO)		
Before intervention	10.6	10.0
After intervention	8.7	8.3
P value	.0001	.0148

*Percent of participants with an increase after washing.
†Percent of participants for whom the interventions had no effect.
‡Percent of participants with a reduction after the interventions.

the amounts of MOs were observed in 39 of 58 participants after washing with SAW (67%) and in 39 of 58 participants after washing with DWWs (67%). An increase in the amounts of MOs was seen in 11 of 58 participants after washing with SAW (19%) and in 13 of 58 participants after washing with DWWs (22%) (Table 4).

The analysis showed a significant reduction in the amounts of MOs after washing with both SAW ($P = .0001$) and DWWs ($P = .0148$) for the paired data. A sensitivity analysis showed that there was no statistically significant difference in the reduction of amounts of MOs between the groin and perineum areas for either SAW ($P = .65$) or DWWs ($P = .15$). Furthermore, there was no statistically significant difference ($P = .84$) in the reduction of amounts of MOs between SAW and DWWs. A sensitivity analysis showed no significant difference in the reduction of amounts of MOs between SAW and DWWs for either the groin ($P = .97$) or the perineum ($P = .51$).

Analysis of the species of MOs with the potential to cause HAUTIs showed that the number of MO species increased in the swab samples from 316 to 339 after washing with SAW and from 279 to 291 after washing with DWWs. However, the amounts of MOs (1, 2, or 3 on an ordinal scale) in all of the swap samples decreased after washing with SAW from 603 to 522 and from 504 to 424 after washing with DWWs (Table 3). The analysis showed a significant reduction in the amounts of MOs after washing with SAW ($P = .0008$) and after washing with DWW ($P = .0001$) for MOs with the potential to cause HAUTIs; however, there was no statistically significant difference ($P = .70$) in the reduction of amounts of MOs between SAW and DWWs (summarized data) (Table 3).

The number of *Escherichia coli* increased from 38 to 44 after washing with SAW and from 28 to 31 after washing with DWWs, and the amounts of MOs (1, 2, or 3 on an ordinal scale) in all of the swap samples decreased from 60 to 55 after washing with SAW and from 39 to 34 after washing with DWWs (Table 3). However, the analysis did not show a statistically significant reduction in the amounts of MOs after washing with SAW ($P = .48$) or after washing with DWWs ($P = .28$) (Table 3). Furthermore, no statistically significant difference ($P = .57$) was seen in the reduction of amounts of MOs between SAW and DWW for *E coli*.

DISCUSSION

The paired-samples analysis showed a statistically significant reduction in the amounts of all MOs and in the amounts of MOs with the potential to cause HAUTIs after washing with both SAW and DWWs. No statistically significant reduction was found in the amounts of *E coli*. When comparing the use of SAW with the use of DWWs, no statistically significant difference was found in the reduction of amounts of all MOs, in the amounts of MOs with the potential to cause HAUTIs, or in in the amounts of *E coli*. Thus, the null hypothesis of no difference in the reduction of amounts of MOs could not be rejected. These findings are in line with other studies[8,9,14] that also found that SAW and DWWs were similar in their ability to reduce amounts of MOs from the skin, although these results may not be directly comparable with the present study. One study was performed on infants,[14] and another study obtained skin swabs 5 days after the washing from skin sites not related to the urethral meatus.[9]

The reduction in amounts of MOs was larger in the groin compared to the reduction in the perineum, but the difference was not statistically significant. The difference could, however, be explained by the groin being easier to wash and swab compared to the perineum. A small reduction of the amounts of *E coli* after washing with either SAW or DWWs was found, but it was not statistically significant. This is an interesting result, given that *E coli* is the primary cause of the majority of HAUTIs.[3] The number of *E coli* found in our study was low (50 for SAW and 33 for DWW), which may explain why the findings were not statistically significant.

Contamination with new species of MOs was observed after washing with both SAW and DWWs. This, too, is in line with other studies[8,9,14] and indicates that the transfer of MOs from the participants' own gut flora or from the environment might contaminate participants during the washing procedure. Contamination may also occur due to variations in how the skin swabs are obtained. Despite contamination with new MOs, the amounts of MOs decreased significantly after washing with both SAW and DWWs. Thus, on average, the participants became microbiologically less contaminated after washing. Both washing methods seem to meet their purpose—namely, to reduce the bioburden on patients' skin and thus potentially reduce the risk of HAUTIs.

Despite the fact that the amount of all MOs was statistically equally reduced after either washing method, the nursing staff sometimes found that it was difficult to wash the patients' visibly clean after fecal incontinence, especially when using DWWs. This is in accordance with other studies reporting that DWWs sometimes are less effective than SAW in removing dirt and feces.[6,13] Thus, from a clinical perspective, SAW and DWWs are not necessarily equally effective.

Strengths and limitations

Even though the pilot study provided some experience of the process, it was a logistic challenge to include more than one participant per day who had an influence on the inclusion rate, apart from reasons related to the individual patients. The main reason for non-participation was the lack of ability to sign an informed consent form. Furthermore, 14 patients dropped out because of unforeseen events. There is a risk of committing a type II error because the study did not achieve the estimated power calculation.

The same person obtained all skin swabs, which contributed to minimizing collection bias; however, even though the swabbing method was standardized, the swabbed skin size, the rolling

technique, and the pressure used when swabbing may have differed. Furthermore, the moist swab may not have collected all of the MOs from the skin.[17]

The random variation in the number of species found for each participant made it difficult to compare the microbiological reduction between the two interventions. As patients are expected to become less contaminated overall after washing, it was considered to be clinically relevant to sum up the amounts of MOs for each participant and each intervention in the statistical analysis.

According to the Danish national guidelines,[3] intimate hygiene for a patient with a diaper should be performed every 12 hours. As the skin swabbing was done at an interval of approximately 24 hours, up to 90% of the participating patients with a diaper may have been washed at least one additional time after the first washing intervention. All patients should be washed after each wet diaper.

The carryover effect in crossover studies[20,21] depends on how rapidly MOs are re-established on the skin, the diversity in the profile of the human skin microbiota, and other individual variations.[23] Using a diaper may also have an influence on the skin microbiota and how quickly the MOs re-establish. Due to the crossover design, the impact of demographic variations on the results was reduced. Intimate hygiene can be performed in many different ways depending on the individual patient's, staff's, and environmental circumstances; however, adhering to local guidelines for the washing procedure before and during the study might have contributed to better consistency.

It is considered a strength that the majority of participants were washed by the same person on both days, as the nursing staff may have differed with regard to individual experience and routines, resulting in differences in how the washing procedures were performed. The same nursing staff washing all of the patients could lead to bias in the procedure because of staff preferences. It was not possible to blind the staff as to what washing method they used. This could also lead to bias in the washing procedure because of staff preferences; in fact, two studies concluded that nurses prefer to use DWWs.[7,8] Furthermore, the staff could have been performing the washing procedures more thoroughly because the person obtaining the swabs was observing them while they did so.

This study did not address long-term effects of using either SAW or DWWs, and it only assessed a specific brand of DWWs. Furthermore, some of the nursing staff heated the DWWs before washing, which may have had an influence on the effectiveness of the wipes.

CONCLUSION

There was no significant difference between washing with SAW or DWWs with regard to their effectiveness in reducing the amounts of MOs on the skin, indicating that both methods seem to be equally effective in removing microorganisms from the skin. There was a statistically significant reduction in the amounts of MOs after washing with either SAW or DWWs, including MOs that potentially could cause HAUTIs; however, both methods introduced contamination with new species of MOs. A small reduction in the amount of *E coli* after washing with either SAW or DWWs was observed, but it was not statistically significant.

Acknowledgments

We thank all participating patients, staff, and wards for their participation in and contribution to the study; Lorna Campbell for her language services; and the University of Southern Denmark, Hospital of Southern Denmark, and Odense Patient Data Explorative Network for their statistical supervision.

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Received: 4 July 2018 | Revised: 23 January 2019 | Accepted: 9 February 2019

DOI: 10.1111/jocn.14825

ORIGINAL ARTICLE

WILEY Journal of Clinical Nursing

Bed bath with soap and water or disposable wet wipes: Patients' experiences and preferences

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Funding information
Unrestricted funding provided by the University Southern Denmark, The Region of Southern Denmark, University College South Denmark and Hospital of Southern Jutland.

Abstract

Aims and objectives: To gain an in-depth understanding of patients' preferences regarding two bed bath methods: soap and water and disposable wet wipes.

Background: Bed baths allow hospitalised, bedridden patients to stay clean and fresh. They serve a number of purposes: health promotion, social propriety and pure pleasure. Traditionally, soap and water have been used for personal hygiene, but in recent years soap and water have increasingly been replaced by the use of disposable wet wipes.

Design: A qualitative study with a hermeneutical-phenomenological approach was chosen to explore and understand patients' experiences of bed bath methods.

Methods: Semi-structured, individual, in-depth interviews with 16 bedridden patients from three wards were conducted. The software program NVIVO was used to structure the transcribed interviews and assist in the initial data analysis. The data were analysed and interpreted within a phenomenological-hermeneutical framework. COREQ guidelines were used in the preparation of this paper (See Supporting information Appendix S1).

Results: Four overall themes were identified: "Creating a sense of cleanliness," "Preferences and concerns in different situations," "Cleanliness of hands and face" and "Clinical decision-making about bed bath method."

Conclusions: Overall, patients' bed bath preference was for soap and water, but disposable wet wipes were considered a convenient alternative and preferred in certain circumstances, for example, when a patient had pain or diarrhoea. Shared decision-making regarding bed bath method is recommended. Hands and face had specific requirements.

Relevance to clinical practice: Nursing staff should be aware that bedridden patients have varying preferences, and it is important to incorporate the patients' preferences in the development of standards, health policies and clinical guidelines for bed bath practices.

KEYWORDS

bedridden, disposable wipes, hermeneutic, patient experience, personal hygiene, phenomenology, qualitative interviews

1 | INTRODUCTION

Nursing staff provides bed baths for hospitalised, bedridden patients to maintain personal hygiene. Bed baths serve a number of purposes: health promotion, social propriety and pure pleasure (Lentz, 2003; Möller & Magalhães, 2015; Shoonhoven et al., 2014). Furthermore, bed baths are regarded as necessary procedures to improve patients' quality of life, social acceptance and well-being (Ahluwalia, Gill, Baker, & Fried, 2010; Downey & Lloyd, 2008; Lentz, 2003; Sheppard, 2000).

Traditional bed baths with soap and water (SAW) are now increasingly replaced with bed baths using disposable wet wipes (DWW) (Groven, Zwakhalen, Odekerken-Schröder, Joosten, & Hamers, 2017; Ogai et al., 2017; Shoonhoven et al., 2014). The prepacked and heated DWW was introduced in nursing practice in 1994 in the USA (Skewes, 1994). A report showed that 71% of bed baths used SAW use and 12% DWW without disinfectants (Coyer, O´sullivan, & Cadman, 2011).

The increased use of DWW for bed baths in Denmark during the past 10–15 years follows the international tendency (Hørdam et al., 2017; Nøddeskou, Hemmingsen, & Hørdam, 2014).

In Danish hospital wards, bed baths are provided to approximately 15% of somatic patients (Nøddeskou et al., 2014). Estimated by number of hospitalised patients' and bed days, this corresponds to approximately 600,000 bed baths per year provided annually to hospitalised patients (Statbank Denmark, 2017).

What does this paper contribute to the wider global clinical community?

- This paper provides insights into and deeper knowledge about hospitalised, bedridden patients' preferences for bed bath methods.
- The general preference was for soap and water, but disposable wipes were considered convenient and were preferred in certain circumstances.
- The results can enhance nursing staff's focus on the inclusion of patients' experiences and preferences in nursing care

2 | BACKGROUND

The provision of hygiene care to patients is a core nursing task (Groven et al., 2017) and is offered on almost all hospital wards (Collins & Hampton, 2003a, 2003b; Sheppard, 2000; Shoonhoven et al., 2014). Bathing has been regarded as a ritualistic pleasure and, in recent times, a necessary therapeutic daily procedure (Sheppard, 2000). In addition, personal hygiene is considered one of our basic needs (Orem, 2001). Bed baths allow bedridden patients to stay clean and fresh. The primary goals of bathing are to maintain hygiene, and to leave patients feeling refreshed, and comfortable. There are other benefits as bathing can remove sweat, oil, dirt and microbes from the skin, decrease body odour and stimulate circulation. In addition, bathing may also reduce the risk of infections (Lentz, 2003; Sheppard, 2000; Skewes, 1994). It has been reported that up to 10% of all admitted Danish patients will get a nosocomial infection (Central Enhed for Infektionshygiejne, 2018). Nosocomial infections are associated with higher mortality rates and represent an economic burden on the healthcare system (Stone, Braccia, & Larson, 2005). Other benefits include the ability to induce comfort, relaxation and reduce pyrexia. In addition, bathing allows nursing staff to assess the patient's skin for integrity and pressure sores (Coyer et al., 2011).

Bathing with SAW can have a direct impact on the epidermis, by posing a number of threats to the integrity and barrier function of the skin. Soap can affect the resident flora and natural lipids and can change skin acidity. Furthermore, it may interfere with the water-holding capacity of the skin and can have a thinning effect on the outermost layers of epidermis and the stratum corneum (Collins & Hampton, 2003a; Massa, 2010; Voegeli, 2008). The use of SAW and subsequent drying with a towel can have a disruptive effect on the skin barrier and tentative evidence shows that a high frequency of bed baths with SAW is associated with an increased risk of skin damage (Voegeli, 2008). It is necessary to remove excess body secretions, but preferably without drying out the skin. Intact skin serves a vital role in maintaining the body's first line of defence against invading microbes (Collins & Hampton, 2003a). Dry skin is also prone to cracks, which could lead to infections and pressure sores (Beeckman et al., 2010; Hampton, 2011). Basins for water used for bed bathing can be a reservoir for bacteria, if not properly cleaned after use, and may be a source of cross-contamination between patients (Greaves, 1985; Johnson, Lineweaver, & Maze, 2009; Marchaim et al., 2012). Furthermore, rubbing the skin during bathing may release skin flora into the basin, which may become a source of cross-contamination between different areas of the patient's body.

DWW may offer many advantages for patients, including a lower risk for cross-contamination, because of limited contact with different body parts, and avoidance of having to use a basin (Collins & Hampton, 2003a; Lentz, 2003; Wright, 1996).

DWW may also leave the patient's skin soft and better moisturised (Sheppard, 2000; Skewes, 1994; Wright, 1996). Furthermore, compared to SAW, DWW seem to enhance the skin barrier function, reduce the risk of skin impairment, reduce dermatitis and pressure ulcers (Beeckman, Verhaeghe, Defloor, Shoonhoven, & Vanderwee, 2011; Hodgkinson & Nay, 2005; Kron-Chalupa, Benda, & Williams, 2006; Lentz, 2003; Massa, 2010; Shoonhoven et al., 2014). However, in an experimental setup, no significant differences in skin physiology were found between washing with SAW and DWW (Ogai et al., 2017).

Additionally there are studies, which support the idea that DWW are easy to use and a valuable alternative to SAW (Groven et al., 2017; Hørdam et al., 2017; Nøddeskou et al., 2014, 2018;

Sheppard, 2000; Shoonhoven et al., 2014; Wright, 1996). A Dutch study even showed that some patients would prefer to exchange washing with SAW for washing with DWW on a permanent basis (Shoonhoven et al., 2014). DWW might help support independence and studies have described that patients like the fact that each wipe only comes in contact with one part of the body (Skewes, 1994; Wright, 1996).

A cluster randomized study (Shoonhoven et al., 2014) of 500 nursing homes residents showed that most of the residents felt refreshed and clean after washing without water. Secondary analysis of the same data found that patients also seemed to receive a more thorough bathing with DWW compared with SAW (Achterberg et al., 2016).

Furthermore, the use of DWW seems to reduce staff time and save costs (Collins & Hampton, 2003a; Larson et al., 2004; Lentz, 2003; Nøddeskou et al., 2014, 2018).

Despite the increasing use of DWW, no in-depth qualitative studies that explored the patient's experiences regarding the two bed bath methods has been identified. The patients' perspective from quantitative studies may not nuance the patients' individual perspective (Groven et al., 2017; Hancock, Bowman, & Prater, 2000; Hørdam et al., 2017; Nøddeskou et al., 2014, 2018; Sheppard, 2000; Skewes, 1994).

Thus, the objective of this study was, through in-depth qualitative interviews, to explore and nuance hospitalised, bedridden patients' experiences of, satisfaction with and preferences for either SAW or DWW bed baths.

3 | METHOD

We conducted a qualitative interview study based on a hermeneutical-phenomenological approach to analyse and interpreting patients' experiences of bed baths with SAW and DWW. Hermeneutic phenomenology is a qualitative research methodology which can be used to understand how individuals experience a common phenomenon (Zahavi, 2003) and is suitable to describe an unexplored phenomenon (Kvale & Brinkmann, 2009; Patton, 2002).The approach was used in the formulation of the research questions, to develop a semi-structured interview guide, the probing questions used during the interviews and in the first step of the analysis. The interviews were intended to create an understanding of a phenomenon from the interviewed person's perspective, to unfold the meaning and importance of their experiences with the intention of setting aside the interviewer's preconceptions (Kvale & Brinkmann, 2009; Patton, 2002). Semi-structured, individual, in-depth interviews allow the interviewer to delve deeply into personal experiences and are widely used to co-create meanings with interviewees, and to reconstruct their perceptions and experiences related to healthcare (DiCicco-Bloom & Crabtree, 2006). COREQ guidelines were used in the preparation of this paper(Tong, Sainsbury, & Craig, 2007) (See Supporting information Appendix S1).

3.1 | Setting and data collection

The inclusion criteria were bedridden patients who were able to speak and understand Danish fluently, were able to understand oral and written information and, able to sign a written consent form. All participants should have experienced bed baths with DWW for a minimum of 2 days in a hospital and have previous experiences of bed baths with SAW. In this study, a bed bath was defined as staff washing the patient's body in bed (Downey & Lloyd, 2008; Shoonhoven et al., 2014). Eligible patients were identified according to the inclusion criteria by the nurse who cared for them during day shifts.

Prior to participation oral acceptance from the patients to hear more about the study was obtained by their nurse. Next, the first author offered potential participants oral and written information about the study. The readability of the written patient information and consent documents was assessed using the Gunning fog index to ensure that the readability level matched the average educational level (Hamnes, van Eijk-Hustings, & Primdahl, 2016).

To ensure heterogeneity in patient characteristics, the aim was to apply a sampling strategy with maximum variation (Patton, 2002). Specified characteristics of potential participants were used in a matrix for participant inclusion, to allow for the selection of a variety of participants (Wacherhausen, 1996). The characteristics included sex, age, occupational background, cohabitation status, ward, length of admission, diagnosis, bariatric information, skin issues, stoma and information regarding use of urinary catheter and diaper. In this study, bariatric information was noted if the nursing staff assessed that the patient required bariatric equipment.

A semi-structured interview guide was developed. The interview guide contained thematic dimensions related to the research question, for example, bed bath with DWW, and a dynamic dimension, expressed in everyday language, for example, "Can you describe how you were washed this morning?" (Kvale & Brinkmann, 2009). The interview guide was developed based on the interviewer's previous experience, conceptual and theoretical knowledge and familiarity with the topic (Larson et al., 2004; Pedersen, Delmar, Falkmer, & Grønkjær, 2015; Sheppard, 2000). The questions were kept brief and easy to understand. Academic concepts were avoided to promote a positive interaction, to optimise conversation flow and to encourage the participants to talk about their experiences (Kvale & Brinkmann, 2009). All interviews were planned to last maximum 1 hr and were digitally recorded and transcribed verbatim by the interviewer. The interviews were conducted in separate consultation rooms in the ward or at the bedside and by the first author across all interviews. The length of each interview was noted.

Participants were included until no new information appeared in three consecutive interviews, in order to achieve data saturation (Francis et al., 2010; Patton, 2002).

3.2 | Data analysis

The transcribed interview became the basis for the analysis and a hermeneutic interpretation (Gadamer, 2004). NVIVO version: 11.4.3

was used to structure the data, ensure a systematic analysis, help reinforce completeness and allow flexibility in the analytical process (DiCicco-Bloom & Crabtree, 2006). Through an initial inductive analysis, themes regarding the specific phenomenon were developed (Kvale & Brinkmann, 2009).

A five-step coding method was employed (Kvale & Brinkmann, 2009).

The first step was to read all interview transcriptions in order to achieve an overall sense of the interviews. The second step was an open initial coding, where natural meaning units, as expressed by the participants, were identified. The third step was a thematic description of the initial natural meaning units, as they were understood by the interviewer. During a second reading, new units and concepts, which were not previously captured, were added to the themes.

Through an axial reading of the interviews, the fourth step was to link the initial themes between the transcripts. The fifth and final step was to condense the initial themes into more overall themes (Kvale & Brinkmann, 2009).

The hermeneutic approach (Gadamer, 2004) formed the descriptions from the analysis and addressed the identified overall themes in three interpretational contexts described as self-understanding, critical common sense understanding and theoretical understanding (Kvale & Brinkmann, 2009). Self-understanding expresses the participant's experience in the transcribed interviews as rephrased and condensed statements. In the critical common sense understanding, the interpretation goes beyond the rephrased and condensed themes while remaining within the context of common sense. This context provided a wider understanding, including general knowledge, which amplified and enriched the condensed statements (Kvale & Brinkmann, 2009).

Some of the patients' self-understanding and critical common sense understanding are presented as findings in the results section.

Interpretation in the third context, "theoretical understanding" goes beyond the participants' experiences of bed baths. The findings are discussed with relevant literature in the Discussion section.

3.3 | Ethical considerations

This study followed the recommendations given in the Ethical guidelines for nursing research in the Nordic countries, published by the Northern Nurses' Federation (Vård I Norden, 2003). Furthermore, the study followed guidelines developed by the World Medical Association and implemented by the National Ethics Committee (World Medical Association, 2001). The local Scientific Ethics Committee found that formal ethical registration and approval were not required (The Local scientific Ethics Committee of Southern Denmark, 2011). The head physicians in the three participating clinics approved the study and formal permission to store the data was obtained by the Danish Data Protection Agency (Danish Data Protection Agency, 2015) (J.No.18/35356). Written consent to participate was obtained.

4 | RESULTS

Sixteen in-depth, individual, semi-structured interviews were conducted, from October 2016–May 2017, with bedridden patients in three different wards at one Danish hospital. Five men and eleven women, with a mean age of 67 (range from 43–81) were included. Participants characteristics are summarised in Table 1. Two participants who met the inclusion criteria declined participation.

The interviews were conducted during admission. The mean length of stay before participation was 8 days (range: 2–35 days). The interviews lasted between 17–41 min (mean: 23 min). Seven of the participants had a cohabitant status and nine were single. Ten were retired, but five of these still had a link to their work. Three of the patients were assessed as bariatric patients' by the nursing staff.

In general, the participants reported that when they were at home, taking a shower was the overall preferred method for personal hygiene, and the participants normally took a shower almost every day. This information was expressed in an unsolicited manner by the patients. Cleanliness was considered absolute necessary and personal hygiene was essential for well-being and self-esteem. Furthermore, many were concerned about odour and expressed that it was extremely important to smell nice. Otherwise, they would feel disgusting and be ashamed.

The analysis derived at four essential themes: "Creating a sense of cleanliness," "Preferences in different situations," "Cleanliness of hands and face" and "Clinical decision-making about bed bath." The participants are referred to by a numbering (P1–P16).

4.1 | Creating a sense of cleanliness

The participants strongly expressed a general preference for the use of SAW for personal hygiene, if given a choice. They highlighted and reaffirmed a belief that the use of SAW made them feel cleaner and fresher than the use of DWW, but they did not know if this was actually true that SAW did clean better. SAW was described as the type of bath that removes bacteria, dirt and sweat from the skin much

TABLE 1 Characteristics of the participants

Patient characteristic matrix	
Ward	Surgical 8
	Medical 4
	Emergency 4
Occupational background	Health professional 5
	Communication 2
	Vocational 9
Diagnosis	Infection 4
	Chronic diseases 7
	Elucidation 5
Other variables	Stoma 5
	Diaper 10
	Urinary catheter 9

more effectively than DWW. They characterised the effect of SAW as being "really washed," and one participant noted that if SAW were left out, it would be unhygienic. SAW helps you feel "really" clean and some participants believed that SAW removed more dirt and was more thorough and hygienic than DWW. The following participants discussed reasons for their preferences for SAW.

> Then I would take soap and water… I just think that it's the best, but why, I don't know… again I think that I am cleaner. (P7)

> I feel that I am cleaner that way (with SAW), I mean, bacteria have to be removed as much as possible … because, in any case, you cannot go around being crusty. (P12)

The participants also discussed social reasons for their beliefs and that bathing with SAW was a part of growing up, traditions in childhood and habits. Because of that, they did not question the assumption that bathing with SAW removed dirt, bacteria and provide a feeling of cleanliness. However, it was difficult for the participants to explain and find the right words for their beliefs.

> It's a cleaning process – I mean, you get oil off your skin. Maybe it's mostly in your mind, I don't know – it's just that you've always done it like that. It's a tradition you could say. (P 5)

4.2 | Preferences and concerns in different situations

Several advantages of using DWW were expressed, which included independence and self-care for bedridden or disabled. Participants described the quality of the wipes and how fast and easy they were to use. The wipes were characterised as big, soft, moist and pleasant, compared to a washing cloth used with SAW.

> I think they (DWW) are soft and they are moist and they are not so big, you can do it yourself, I'm so plagued with rheumatism all over, so I can, like, I can hardly move this arm anymore – but I just think they are so good – they work so well for me. The first time they opened one up and I had to use it myself … then I thought, no it's moist, and it's not that big and so soft, and that, I could sort of notice that I felt washed. I think I could really feel that. (P15)

It was convenient and faster to use the wipes if they had pain or diarrhoea, because it would take a longer time to bathe with SAW and it required multiple actions. One had to wash with soap, rinse with water and dry all parts of the body with a towel. In contrast to this, DWW required only one action.

> Yes, yesterday I was washed with soap and water, and I think that it was actually very uncomfortable. I had so much pain and she keep saying that I should do it myself and I just couldn't and then she came up with the solution soap and water – you simply cannot dry off like you can with the (DWW) – and it should be dried and it should … there you would want her to use DWW. (P4)

Washing with DWW was described as a way to freshen up, but if the participants were visibly dirty with sweat, dirt and emanated an odour, they did not feel they were clean or smelled clean after using the wipes. Some participants even expressed very clearly that they did not like to be washed with DWW.

> I think they (DWW) are great for freshening up – like now, for example, let's say you have just come from surgery and you wake up and you need to be refreshed a little before bedtime on your forearms – I think they are quite good – but I don't like to be washed with them. (P10)

Other participants discussed the difference between "freshening up" and being "really washed." They described their concerns and doubts about cleanliness. Being washed with DWW was definitely preferred to no bathing, but was judged to be the second choice, after SAW.

> Yes that's it, and if you just have to freshen up or that, they're fine. Well, it (soap) doesn't wash you any better, but I think it's like I haven't been washed (with DWW), I don't think so – I don't feel that with the wipes. It's better than nothing, of course – so you are freshened up. (P 8)

In contrast, other participants felt clean and appreciated the advantages by using DWW as an alternative washing method.

> No, I actually think I feel pretty clean (with DWW). (P9)

> You feel you're clean and, really, I don't have anything against it. (P 12)

Other concerns about DWW were expressed. Some of the participants described that it was as if the DWW left a layer on the skin, which they expressed as "oily or a film." After using DWW for several consecutive days, they also described that the skin turned dry and scaly. In addition, other participants described redness, skin irritation and itchiness of the skin, which were linked to recent skin problems, such as eczema or flaking skin.

> It's as if the skin can't really get air, or… But, I just think there's just, like, a film, over it. (P 11)

Bed baths with DWW did not necessarily include subsequent drying off with a towel. Participants described the moist feeling left on the skin after a bath with DWW. It took time to dry and they expressed having the sensation of moist skin for a long time, compared to the use of SAW. Some did not like to have wet skin for long time, and in addition, this was associated with feelings of not being clean.

> I think, like those wipes, (the skin) is not dry straight away, but with soap and water, if you use a towel, you know … (the skin) it's like it's damp. (P16)

However, other participants expressed great satisfaction with DWW, including benefits to skin integrity, softness and the fact that they did not need to apply lotion after washing.

> The skin is also dry (after using soap) and then you have to use body lotion … and I don't think you feel that with the wipes, it's not at all the same, it's (the skin) softer. (P 4)

Both preheated and cold DWW had some advantages for those who had experienced them. Preheated DWW were considered to be very nice, especially if the participants were cold in bed. Other participants appreciated the coolness because it was comfortable on their warm skin, if it was hot from fever or if they felt sweaty.

> It was really lovely. I don't know if they heat them in the microwave … It was great – I didn't realize that it could be done … (P 3)

4.3 | Cleanliness of hands and face

All participants who mentioned the face and hands pointed out that their needs and preferences for these two body parts were different from the rest of the body. They described the need to use SAW as extremely important when it came to the hands. They wanted their hands to be "really clean," because hands touch everything in the environment and are used to put food into the mouth. Furthermore, the participants expressed that the use of SAW helped them feel "really" clean.

> Yes, I don't know, it could be that it's the habit, again – I don't know, I feel I'm cleaner when I stand and rub myself with soap, and … It's important, because you are putting things in your mouth, aren't you, and it (the hands) has to be clean, so, yes that's an important factor. (P 12)

> Soap and water is number one, yes … you can't explain it… I don't know, it (SAW) might be cleaner – I don't know … more comes off, and it's cleaner than with wipes, to get them (my hands) clean and it's more hygienic too… (P13)

Furthermore, the participants pointed out the need to wash their hands with SAW at least once a day and always after using the toilet.

> No, I want to go and wash my hands at the sink once a day. (P 8)

In addition, other participants expressed concerns about the use of DWW for handwashing. The expressed film was also left on the hands and described by one participant as "clammy."

> Yes, and I feel as well that there is a sort of a film after (using the DWW) … a layer – on the fingers, again it's that soap, that doesn't get washed off, you know… (P10)

Some of the participants did not like their face to be washed with DWW because the skin felt strange afterwards. The feeling in the face was described as "tight" and that it felt like it needed to be moisturised after washing. They also pointed out that facial skin is different to the rest of the body. They did not want soap in their face, either, and preferred water only or other personal cleaning agents, such as oil or cleansing fluid.

> Yes, I also tried them (DWW) … I don't like them on my face. (P 3)

> But I've been washed with them (DWW). I feel it on my face today … It's as if the skin needs to get, like, moisture. (P4)

> I don't use soap on my face … I use cleansing cream. (P5)

In contrast, other participants did not mind using DWW on their face and said it was good enough and that you felt freshened up. They stated that they felt that something was done to feel fresh and washed.

> It's fine – the only thing is, when washing your face … just like, you know, when you're on a plane you get those wipes … they're refreshing … but they ensure you're at least, you feel at least that you've done something. (P 4)

4.4 | Clinical decision-making about bed bath method

Some participants expressed that the opportunity to have a bed bath and to maintain personal hygiene was more important to them than whether it was performed with SAW or DWW.

> I don't really have an opinion on that – when you are sick it doesn't matter a damn, so it's all the same – just as long as you are washed. (P 1)

In contrast, other participants discussed concerns about the clinical decision regarding the type of bath, in relation to the actual situation and condition of the individual patient. They expressed the importance and complexity in the choice of bathing method, depending on whether they were bedridden, had pain, the length of stay and how it fitted the situation. Some of the participants even discussed economic issues, and which method they believed was most cost-effective. The participants also pointed out that it was faster for the staff to use DWW.

> So, it was the wet wipes – the other is too hard to use. I think if they (the patients) are out in the bathroom, it's going to be soap and water. It depends on the situation, of course. (P12)

Participants expressed that the decision regarding type of bath should be taken by the nursing staff and should be related to the workload and clustering of other care activities on the ward. They expressed strong acceptance of the nursing staff's decisions and that the nursing staff did it in their own way and decided what they found suitable in the situation. The participants were not always offered a choice. Some participants did not want to be asked at all, because they did not think it was possible to choose SAW while they were bedridden. Other participants discussed whether the nursing staff should ask at all, because the patients experienced bustle on the ward, while other participants would like the nursing staff to ask for their bed bath preferences before their daily hygiene routine, if possible.

> No (I don't want to be asked) and it's also easier for the staff (pointing to the DWW). So, I assume they use (SAW) when I can sit up … and when I'm in bed, they use a wet wipe. (P4)

> When you are lying in bed, you can't use soap and water. (P9)

> Yes, I think so – you should be allowed to choose for yourself. (P10)

> No they just wash me … no, it's all the same, I take it as it comes … I'm very satisfied with that. (P7)

> It doesn't matter, they have their own ways – they just do whatever works for them. (P 1)

5 | DISCUSSION

This study aimed to gain an in-depth understanding about patients' preferences regarding two types of bed bath, the use of SAW and DWW. The participants strongly preferred SAW for personal hygiene, a preference that they stated was linked to traditions held since childhood. However, this finding cannot be taken in isolation, because many of the same participants also described washing with DWW as a chance to freshen up and that this type of washing was convenient and preferred in specific situations. They expressed that the face and hands needed special attention and that neither soap nor DWW belonged on the face. While some thought it was acceptable to use DWW on the face, and handwashing was overwhelming linked to SAW. Despite these findings, many participants also pointed out that the type of bath was less important than the overall need to be washed. Furthermore, the participants expressed different attitudes regarding their bed bath preferences, which reflected the individual value they placed on personal hygiene during admission.

Another important advantage related to DWW was that they promote independence, as patients could wash themselves despite their disabilities, and thus they were convenient and could be used independently of the nursing staff's priorities on the ward.

Nearly, all the participants showered almost every day at home and the findings in this study illuminated that taking a shower was the overall preferred method of maintaining personal hygiene. This is in the line with another study, which showed that 90% of adults take a shower minimum twice a week (Sheppard, 2000). All participants compared their experiences of the two types of bed baths with taking a shower, and they would definitely choose a shower during admission, if it was possible.

Other studies also reported that patients were more significantly positive and satisfied after showers, compared with after bed baths, and that a bed bath is not experienced as being equal to a shower (Hancock et al., 2000; Lopes, Nogueira-Martins, & de Barros, 2013).

The participants described washing as a mandatory daily necessity, which had an impact on integrity, self-image, personality and well-being. This is consistent with other studies, in which bathing is described as an important and meaningful activity. It is a means to becoming clean, it is related to notions of well-being and virtue (Ahluwalia et al., 2010; Downey & Lloyd, 2008) and it is considered important for the self-image (Massa, 2010). The importance of bathing is instilled during childhood, and sociocultural factors, such as cultural beliefs and family practices, influence hygienic care (Collins & Hampton, 2003b). Furthermore, it seems that, in Western societies, there is a stigma attached to uncleanliness and odour and there is a social expectation that one bathe (Ahluwalia et al., 2010). This could explain why the participants expressed that they felt ashamed and disgusting because of odour, if they did not wash every day during admission.

Overall, the participants did not always experience cleanliness after washing with DWW, and they described DWW as leaving a layer on the skin. The consequences for the patients could be an uncomfortable feeling of not being clean in the same way as they were used to, and especially if they used DWW several days in a row. This has also been elaborated by others, including that most people can become distressed if they cannot keep as clean as they are used to, and running water is generally believed to be the most effective cleansing agent (Collins & Hampton, 2003a). Contrary to

our findings, other studies have found that the patients felt clean using DWW (Kron-Chalupa et al., 2006; Sheppard, 2000) and would trade SAW for DWW (Groven et al., 2017; Shoonhoven et al., 2014).

Participants in our study preferred SAW, and in general, they considered that this method really leaves one clean. This is in line with a recent study, which also found that patients tend to prefer SAW (Nøddeskou et al., 2018). In addition, participants in our study specifically wanted SAW for handwashing. This has not been identified in other studies.

Contrary to these findings, some quantitative studies concluded that DWW was predominantly preferred by the patients (Kron-Chalupa et al., 2006; Nøddeskou et al., 2014; Sheppard, 2000; Shoonhoven et al., 2014).

Some participants in the current study discussed DWW as a fast and easy type of bath, which can be less burdensome if they had pain or diarrhoea and was considered to be a convenient way to freshen up. Other studies support that DWW for bed bath is time-saving, easy and less distressing for the patients, compared to the use of SAW (Hørdam et al., 2017; Kron-Chalupa et al., 2006; Lentz, 2003; Nøddeskou et al., 2014; Sheppard, 2000).

The nursing staff did not always ask for patients' preferences regarding bed bath method and the majority of the participants felt that the nursing staff should make the decision about the type of bath. The decision should follow their workload and other care activities.

This is in accordance with a review, which concluded that the important stakeholder with regard to the clinical decision is the nursing staff, and that they often decide the type of bath without shared decision-making with the patients (Groven et al., 2017).

The findings in our study indicate that many patients accept this, as they see that the nursing staff are busy, and that it is faster to use DWW.

There may be different values and preferences according to the type of bath between the patients and the nursing staff. In a descriptive study of bed bath practices, nurses report that other factors such as no policy, lack of knowledge and workload affect their decisions (El-Soussi & Asfour, 2016). Because of this, the patients who want to have influence on the choice of bed bath method should be given the opportunity to choose bed bath as a shared decision, where special concerns such as pain (Möller & Magalhães, 2015), and requirements for hands and face can be taken into consideration. This is supported by the Danish home care study, which found that patients want to have the choice of type of bath (Hørdam et al., 2017).

5.1 | Methodological strengths and limitations

Sixteen participants were included in this study. The recommended sample size in qualitative research is between 6–12 interviews (Onwuegbuzie & Leech, 2007; Patton, 2002), but according to Patton, there are no rules for sample size in a qualitative enquiry.

We aimed to achieve data saturation (Francis et al., 2010), indicated by three consecutive interviews in which no new additional information appeared. This was evident after 16 interviews and contributed to validation of the final sample size.

In small studies, heterogeneity can be a problem. Maximum variation was aimed for, because it can turn that weakness into a strength, by capturing in-depth, detailed information simultaneously with emerging patterns across cases (Patton, 2002). The inclusion from three different wards contributed to the heterogeneity, as did the other chosen variables. Fluent Danish as inclusion criteria might exclude ethnic minorities whose opinions could be vastly different.

Although the interviews were conducted during the patients' present admission, their experiences might be mixed with experiences from other admissions and private use of SAW and DWW. This study was related to a specific brand of DWW, which was used on all the wards at the hospital. Other brands may feel different, because of different ingredients and textures of the wipes. The included patients could have experience of different brands of DWW and may not be able to separate their experiences.

In addition, nursing staff will probably have different experiences of, attitudes towards, and preferences relating to DWW, which can influence how they perform the two types of bed bath and thus have an impact on the patients' experiences.

A patient's planned discharge and length of stay could also influence their experiences. One might be more indifferent to the type of bath and whether one is involved in the decision, if discharged was planned the day after the interview, or if the patient was hospitalised for a long time. On the other hand, the patients could be more negative towards DWW if they did not know their discharge date and thereby did not know how soon they would be able to take a shower or bath at home with SAW.

Given that the interviews were conducted on the wards and that the interviewer's uniform was similar to those worn by the nursing staff, the participants might have been reluctant to express all of their opinions. The patients could feel caught in a loyalty dilemma, together with the fact that they were asked about nursing care on which they were dependent. This could have influenced the participants' opinions—although the interviewer's independent status on the ward was pointed out at the beginning of all the interviews. The interviewer's female nursing background and previous work with intimate hygiene from a philosophical perspective may have influenced the findings, and other researchers may analyse and interpret the data differently.

6 | CONCLUSION

Personal hygiene was an unavoidable task during admission, and maintaining personal hygiene was linked to traditions held since childhood. Shower would be the patients' first choice if not bedridden.

In general, the preference for bed bath type was the use of SAW, but DWW was considered to be a convenient and preferred method in specific situations, for example when the patient was in pain, suffering from diarrhoea or if the patients wanted to freshen

up or get washed quickly and easily. Washing the face was special and pure water was preferred. Contrary to this, the patients felt that the hands needed to be washed by the use of SAW and at least once a day.

Nursing staff should incorporate patients' preferences of shared decision regarding choice of bed bath method when possible and if the patients want this.

The findings addresses some of the patients' experiences but indicate a need for additional research about nurses' preferences, which could also include studies of other bed bath methods and a cost-effectiveness comparison of the two types of bed bath.

7 | RELEVANCE TO CLINICAL PRACTICE

The findings should remind nursing staff to acknowledge and include patients' experiences and preferences in shared decisions about the appropriate type of bed bath for hospitalised, bedridden patients. The findings are relevant for the future development of guidelines for clinical nursing.

ACKNOWLEDGEMENTS

Thanks to all participating patients, staff and wards for their participation and contribution to the study. Thanks to Lorna Campbell for language edition.

CONFLICTS OF INTEREST

None.

AUTHOR CONTRIBUTION

PLV gathered all the data in the study and takes full responsibility for the integrity of the data and the accuracy of the initial data analysis. PLV, CSJ, JS, MC and JP contributed to the study design, analysis, interpretation and drafting the manuscript, revision, review and final approval of the manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Veje PL, Chen M, Jensen CS, Sørensen J, Primdahl J. Bed bath with soap and water or disposable wet wipes: Patients' experiences and preferences. *J Clin Nurs*. 2019;00:1–10. https://doi.org/10.1111/jocn.14825

Costs of Bed Baths: A Scoping Review

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Evaluative research into bed baths often includes cost analysis, but these analyses frequently lack transparency and well-structured comprehensive cost models. This scoping review found significant variation in costing methodology and estimates of bed bath costs.

Nursing staff often provide bed baths for bedridden patients (Groven et al., 2017). The cost of a single bed bath is low as the cost only includes staff time and a few consumables. Such costs could be perceived as unimportant to the overall cost of hospital care.

However, in a hospital or a medical department, the time nursing staff spend on bed baths over a year may be considerable. With increasing pressure on nursing staff's time, hospital management should focus on ways to increase staff efficiency through application of new technological solutions.

The traditional method for bed baths is use of soap and water (SAW), but disposable wet wipes (DWW) have been introduced as an alternative (Groven et al., 2017). Implementation of changes in bed bath practice from using SAW to DWW should be based on documented advantages and disadvantages.

Previous studies have shown that patient preferences for bed bath practice might differ between individuals and situations, and there is currently no conclusive evidence to support that patients generally prefer either of the two methods, as long as they can be washed when needed (Veje et al., 2019a).

In a hospital setting, the hygiene impact of bed baths is important. Bed baths may reduce the risk of hospital-acquired infections and related complications, which may require additional treatment and delayed discharge. Studies comparing the two washing methods have not found differences in the efficiency to reduce the presence of microorganisms on patients (Larson et al., 2004; Matsumoto et al., 2019; Veje et al., 2019b).

With no clear patient preference and no apparent difference in effects of the two washing methods, the relevant factors in determining guideline recommendations may relate to ease of provision, use of nursing time, and use of consumables and the aggregated costs.

Analysis of resource use and costs can be designed and con-

ducted in different ways and depends on the intended application of the results (Welton et al., 2018). In many studies that have considered the cost of bed baths, assessments often lack details and transparency regarding which and how costs have been analyzed (Büyükyilmaz & Şendir, 2017; Larson et al., 2004; Shoonhoven et al., 2015).

This review of the literature contributes to clarifying the costs of nursing time and consumables. The objective was to conduct a scoping review of published scientific articles that have analyzed the resource use and costs of providing bed baths. The review focuses on the methodological conduct of such studies to identify good practice when analyzing the resource use and cost of bed baths.

Methods

This scoping review was conducted and reported per the PRISMA-ScR guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analysis for Scoping Reviews) (Tricco et al., 2018).

A scoping review includes five stages: identifying the research questions, identifying relevant studies, selecting relevant studies (without quality assessment), charting data from the studies, and collating, summarizing, and reporting the results (Levac et al., 2010).

There is a range of methods for costing nursing services (Dowless, 2007). For a well-defined procedure such as bed bath, an appropriate method for analysis is referred to as *activity-based costing* in the health management literature and *micro-costing* in the health economics literature (Welton et al., 2018). This method obtains measures of actual use of resources (e.g., staff time and consumables) and values of these in monetary terms. Another technique is the time-based activity driven costing, which only requires two parameters: the capacity cost rate and the staff time needed to perform the activities (Keel et al., 2017).

Before embarking on a cost assessment, it is essential to define the scope for the analysis. Who will use the cost estimates and for what purpose? If the cost estimates are to be used in a cost-effectiveness analysis, only incremental costs may be necessary (the cost difference between the experimental and comparison procedure). However, if the intended use is in a budget impact analysis, then the full cost will be relevant. Also, for budgeting and consideration of efficiency improvement, it may be pertinent to include all costs related to hospital budgets.

Typically, bed bath costing is relevant to hospital and departmental nursing management to inform decisions about standard procedures for bed baths. In this case, the perspective of the cost analysis can be restricted to hospital resources (disregarding resource use elsewhere) over a relevant period (e.g., one budget year).

Identifying the Research Questions

Cost analysis involves three phases: identification of relevant resource items, measuring the use of these resource items in the care process, and assigning a value to each resource item (Beecham, 2000). Relevant resource items for bed baths include nursing staff, consumables, and equipment. The focus of this review is on how this identification, measurement, and valuation processes have been conducted in the literature.

Identifying Relevant Studies

A literature search was conducted to identify relevant, published, scientific papers that report on empirical analyses of the resource use and costs of bed baths. The PCC (Participants, Concepts, and Context) framework was used to specify the search strategy (Peters et al., 2015).

The definition of bed baths was the washing of the whole body or parts of the body of bedridden patients who were too frail and immobile to shower. Bed baths could be provided by nursing staff in hospitals, nursing homes, or in patients' homes.

The search strategy was performed in three steps. First, an initial scoping search was conducted to identify relevant keywords and search terms. All search terms were checked with truncations and whether they were defined in the databases. The applied search terms are presented in Table 1. This was followed by a systematic data-

Table 1.
Search Terms

1.	bath* OR hygiene* OR clean* OR wash OR washes OR washing OR genitalia OR meatal OR meatus OR penile OR intimate OR perineal OR urethral OR perineum
2.	wipe* OR basin* OR bowl* OR towel* OR washcloth* OR soap* OR water OR rinse-free OR disposable OR prepackage* OR basinless
3.	costs* OR economic OR timesaving OR time and motion OR time saving
4.	patient* OR aged OR elderly OR homecare OR Hospitalized OR bedbound OR bedridden OR inpatient OR admitted OR client

*Denotes truncation

base search for published peer-reviewed studies and a search for grey (not peer-reviewed) literature. A search of search terms and a free texts search in title and abstract were performed.

The literature search was conducted in PubMed, CINAHL, Scopus, Embase, and the Cochrane library databases. A search for grey literature (dissertations, theses, ongoing trials, and other online scientific documents) was performed using the web search engine Google Scholar. In addition, a manual search was performed based on reference lists and bibliographies of relevant articles and reviews. Language was restricted to English. Databases were searched from their inception date until the end of March 2019.

Study Selection

One reviewer (PLV) conducted the searches supported by experienced research librarians. The identified references were transferred to the reference software, Endnote, and duplicate references were excluded. Based on inspections of the titles and abstracts, studies were categorized as *potentially relevant* or *irrelevant* by PLV (Bramer & Bain, 2017). References deemed potentially appropriate were obtained as full text. A few full-text references could not be retrieved. The final selection of studies was based on scrutiny by two researchers (PLV and JS) of the full-text papers with the specified relevance criteria as recommended by guidelines for scoping reviews (Levac et al., 2010).

Charting the Data

To categorize the studies, a standardized charting form was developed and revised during the research (Levac et al., 2010). The selected papers were described in terms of author, year, country, bed bath methods, setting and sample, study design, study period, unit of analysis, measure methods, and reported time. Concerning the cost analysis, the included resource items were categorized. Also, the mean costs were reported as they appeared in the papers and were converted to 2018 U.S. dollars using the mid-year currency rate for the reported year and relevant price indices to account for inflation and price changes.

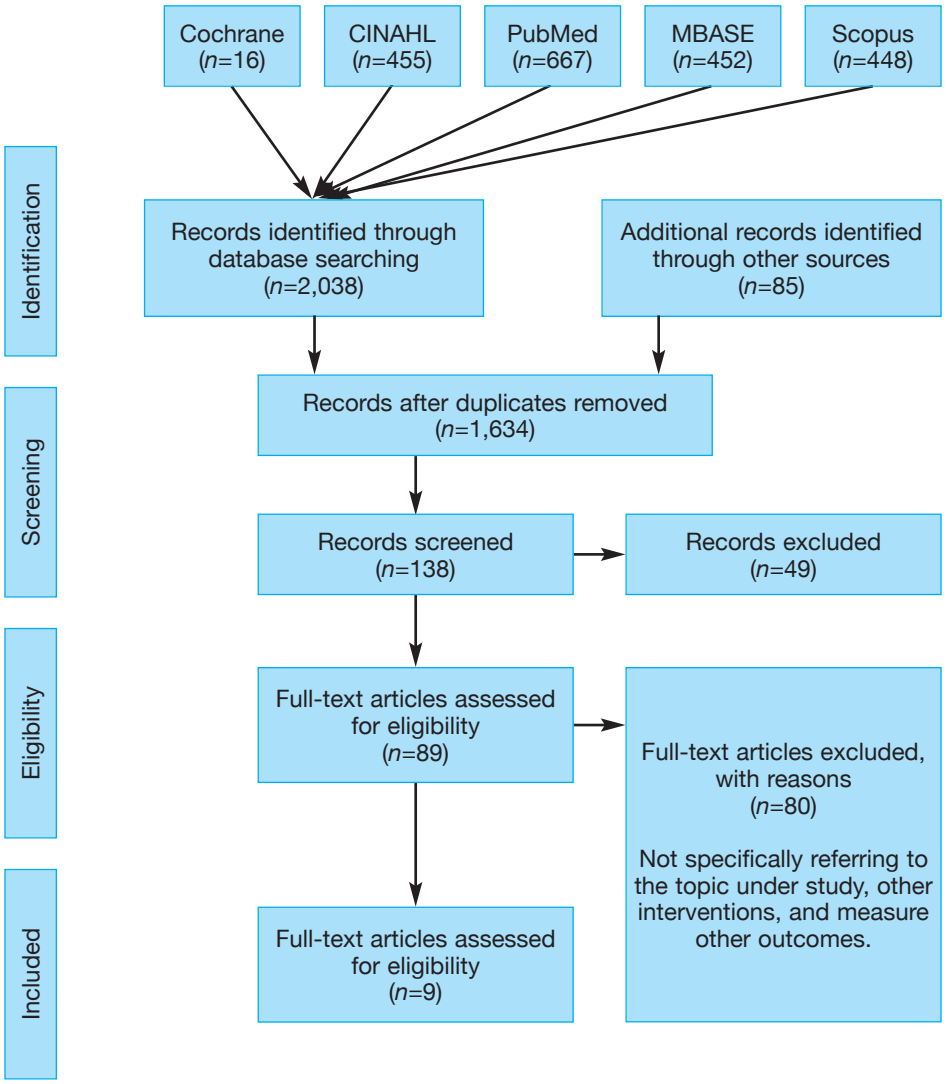
Results

Figure 1 shows the result from the screening process leading to the final nine included studies in Figure 1. The nine included studies are summarized in Tables 2 and 3.

Five studies originated from the United States and one from Australia, Denmark, The Netherlands, and Turkey, respectively. The studies were conducted in different settings: six studies were conducted at a hospital (Büyükyilmaz & Şendir, 2017; Carruth et al., 1995; Hancock et al., 2000; Larson et al., 2004; Nøddeskou et al., 2015; Wright, 1996) and three in other settings (Kron-Chalupa et al., 2006; McGuckin et al., 2008; Shoonhoven et al., 2015). Two studies used towel interventions and one used disposable washing gloves while the six remaining studies used some type of disposable wipes (Büyükyilmaz & Şendir, 2017; Carruth et al., 1995; Kron-Chalupa et al., 2006; Larson et al., 2004; Nøddeskou et al., 2015; Wright, 1996). The studies employed a range of study designs, including one randomized cluster trial (Shoonhoven et al., 2015) and two with a crossover design (Larson et al., 2004; Nøddeskou et al., 2015) (see Table 2).

The duration of the studies varied from 3 days to 18 months and were conducted between 1995 and 2017. Unit of analysis was typically per patient or bath, and the time horizon ranged from weeks to years. Nearly all the studies employed time and motion data, but only three studies described the used

Figure 1.
Flowchart of the Screening Process



data collection methods (Larson et al., 2004; Nøddeskou et al., 2015; Shoonhoven et al., 2015) while one study relied on self-reported data (Buyukyilmaz & Şendir, 2017). The different resource variables included in the nine studies are shown in Table 3.

Running costs (e.g., staff time and consumables) were identified in all studies, while five studies also included capital costs. Nearly all studies included and measured staff time, but there were methodological differences in the costing of staff time. All studies included costs of direct staff time use without any uplifting to include the cost of the direct time (i.e., a load factor), ratio of maximum work time per staff (e.g., 1,924 hours per year), and mean time spent (observed) with patient care (e.g., 1,400 hours per year) (Beecham, 2000).

Table 2.
Included studies and characteristics (listed by first author)

Authors, Year, Country	Objective	Bed Bath Methods	Setting and Sample	Study Design	Study Period	Unit of Analysis	Measure Methods Time/ Resources	Time in Minutes	Cost Result	Adjusted 2018 US $ values
Carruth et al., 1995, USA [45]	To compare the cost of SAW to DWW	Traditional bed bath and bag bath	North Oaks Medical Center. Medicine, surgery, telemetry, intensive care unit	Survey	2 weeks	One bath	NA/NA	SAW: 30 DWW: 15	SAW: 6.22 $ DWW: 2.24 $	10.54 4.06
Wright, 1996, USA [44]	To assess patient and staff opinions about DWW and costs	Standard bed bath and bag bath	Fairfax Hospital. 32-bed, medical and surgical unit, 65 patients, 32 staff	Survey, questionnaire	30 days	One bath RN/NA	OBS/NA	SAW: 21 DWW: 7	SAW: 7.05 DWW: 4.68	11.61 7.70
Hancock et al., 2000, Australia [15]	To compare the impression of patient and staff relations to two bed-bathing methods and obtain data regarding cost	Traditional bathing and soft towel bed bath	Royal North Shore Hospital, Northern Sydney Area Health Service. Surgical and medical wards. 200 patients, 200 nursing staff	Questionnaire	6 months	One bath	SELF/ EXPERTS	SAW: 16 Other: 10	SAW: 3.79 AU$ Other: 2.84 AU $	4.28 2.04
Larson et al., 2004, USA [17]	To compare SAW with DWW in terms of time, quality, microbial counts, nurse and patient satisfaction and costs	Traditional bath and disposable bath	New York Presbyterian Hospital Columbia. Three intensive care units, medical and surgical. 47 patients, 40 nurses	Crossover	12 weeks	One bath	OBS/OBS	SAW: 14 DWW:13	SAW: 19.87 $ DWW: 18.15 $	27.18 24.84
Kron-Chalupa et al., 2006, USA [48]	To compare DWW to SAW for effectiveness of improving dry skin, patient and nurse satisfaction, and cost effectiveness	Traditional basin bath and basinless bath	Iowa City Veterans Affairs Medical Center. Progressive care unit, surgical unit. 60 patients	Quasi-experimental	3 days	One bath	NA/NA	SAW: 21 DWW: 10	SAW: 7.01 $ DWW: 4.90 $	8.98 6.28

continued on next page

Costs related to laundry service were measured in most of the studies, but only one included costs of water consumption. Very few of the studies included electricity or sewage-related costs. Capital costs, such as the use of basins, were reported in most of the studies and were included in the cost calculation in some. Three studies reported the cost of a microwave oven. None of these studies included service cost or equivalent annual costs (Drummond et al., 2015) of capitals such as buildings, basins, or microwave. No studies considered the cost of extra building space related to storage of washing equipment. Furthermore, none of the studies considered environmental impact.

Discussion

A cost analysis should be transparent, reproducible, and reflect current clinical practice to be relevant for decision-making. From these literature reviews, it appears there are many challenges in estimating and reporting the costs of the different bed bath methods.

It is notable that many of the cost analyses have used assumptions of resources used and unit costs and included only selected cost items. This implies the cost studies may not adhere to the gold standards for cost analysis, where inclusion of all relevant costs is required (Dakin & Wordsworth, 2013; Drummond et al., 2015). Further, some of the included studies were not explicit about the analytical units (patient,

Table 2. (continued)
Included studies and characteristics (listed by first author)

Authors, Year, Country	Objective	Bed Bath Methods	Setting and Sample	Study Design	Study Period	Unit of Analysis	Measure Methods Time/ Resources	Time in Minutes	Cost Result	Adjusted 2018 US $ values
McGuckin et al., 2008, USA [47]	NA	Basin, water, paper towels, and pre-packaged bath towel	An institution	Case study	18 months	Bath per 9 months	NA/NA	NA	SAW: 224,916 $ Other: 117,175 $	268.96 140.07
Nøddeskou et al., 2015, Denmark [6]	To compare SAW to DWW in factors of duration, quality, cost, nurse and patient satisfaction	Traditional basin bed bath and disposable bed bath	One hospital, medical ward, 65 patients, 6 nurses	Crossover RCT	8 weeks	One bath	OBS/OBS	SAW: 36 DWW: 29	SAW: 115.09 Dkr DWW: 94.41 Dkr	18.33 15.07
Shoonhoven et al., 2015, The Netherlands [3]	To compare bed bath for effects on skin integrity and resistance against bathing and cost	Traditional bed bath and prepackaged disposable wash gloves	Institutional long-term care. 56 wards in 22 nursing home wards, 500 residents, 275 nurses	Cluster randomized trial	6 weeks	Bath per 6 weeks	OBS/OBS	SAW: 9 Other: 8	SAW: 5.79 € Other: 5.24 €	7.12 6.08
Büyükyilmaz & Şender, 2017, Turkey [22]	To compare SAW with the DWW in terms of two outcomes: nurse satisfaction, and preference and cost analysis	Traditional basin and disposable wipes	University hospital, intensive care, general surgical, orthopedic, neurosurgery, 41 nurses. Self-reported time data	Quasi-qualitative and descriptive	3 months	One bath	SELF/ EXPERTS	SAW: 30 DWW: 20	SAW: 4.48 $ DWW: 2.46 $	4.35 2.38

SAW = Soap and water
DWW = Disposable wet wipes
NA = Not Applicable
OBS = Observations
SELF = Self-reported
RCT = Randomized control trial

bath, unit, ward, hospital) and time period, which is important for the cost assessments. Pollution and life-cycle assessments were not considered in any of the studies. Measures of resource use were obtained from a variety of sources, including expert estimates or registration as part of controlled clinical trials. The accuracy and validity of these measures may be different and thus influence the cost assessment and comparability between studies.

Running Cost

The procedures for calculating and analyzing running cost of different interventions are not simple. Different items may be relevant for costing of a bed bath and the choice may be context related. Assuming a fixed resource use may not be appropriate if patients require a varying number of wipes related to their body size, sweat production, and whether all the wipes from one package can be used for only a single bath or patient. Also, it is unclear how the selected cost items (appropriate equipment for bed baths) were validated (e.g., by different clinical expert opinions) (Beecham, 2000).

With differences in procedures, it is relevant to measure the exact time used to conduct a bed bath if realistic comparison should be made of the nursing staff time needed to wash patients according to guidelines. However, guidelines are generally designed with the ideal situation in mind and, in study design, patients may not have similar needs.

Table 3.
Resource Variables of Bed Bath Methods

Studies (Listed by first author) Structure (X/O)[1]	Carruth et al., 1995	Wright, 1996	Hancock et al., 2000	Larson et al., 2004	Kron-Chalupa et al., 2006	McGuckin et al., 2008	Nøddeskou et al., 2015	Shoonhoven et al., 2015	Büyükyilmaz & Şendir, 2017
Running Cost	X	X	X	X	X	X	X	X	X
Staff time	X	X	X	X	X		X	X	X
Load factor[9]									
Consumables[2]	X	X	X	X	X	X	X	X	X
Waste			0						0
Laundry service	X	X	X	X	X			X	
Electricity[3]			0	0			0		0
Water			X	0		0		0	0
Sewage				0					
Capital Cost	X	X		X	X	X	0	0	
Microwave/Decontaminator	0	0					0		
EAC[8]									
Basin	X	X		X	X	X	0	0	
EAC[8]									
Buildings[10]									
EAC[8]									
Consequences	X	X	X	X	X	X	X	X	X
Infection/HAI[4]/UTI[5]/LOS[6]						X			
Basins harboring MOs[7]	0	0		0		0			
Skin impact	0	X	X		X			X	X
Patient	X	X	X		X		X	X	X
Staff	0	X	X	X	X		X	X	X

[1] X = present and measured, O=present and not measured
[2] Consumables included supplies and equipment
[3] Electricity included heating
[4] Hospital-acquired infection (HAI)
[5] Urinary tract infection (UTI)
[6] Length of stay (LOS)
[7] Microorganisms (MOs)
[8] Equivalent annual cost (EAC) including investment, lifetime, service, and activity
[9] Load factor or overload calculated as ratio work hours
[10] Buildings included facilities, rooms, installation, and storage

The ideal setup for a costing exercise would be to compare time used for identical mock-up situations. However, this could be difficult to generalize to larger populations and for different patient groups, and it might be difficult to compare cost methods between settings, hospitals, and countries.

Notably, it seems to take less time for the staff to use DWW than SAW in the majority of the studies. Thus, it is relevant to discuss how the time and motion studies were conducted, and if they were done appropriately. The process of giving a bed bath could be broken down in distinct phases (e.g., preparation for the bed bath, actual bed bath, and tidy-up period after the bed bath) (Nøddeskou et al., 2015). Only some of the studies recorded the time devoted to each task (time and motion study) and provided clearly defined start and endpoints. One study did not include the time needed for

preparation and clean up (Larson et al., 2004). Also, not all studies discussed how other activities, such as interruptions during time taking and putting on and removing gloves, were handled.

Recording of time and motion was performed by external observers in some studies (Frick, 2009; Lopetegui et al., 2014). Such studies require a one-to-one observer ratio and are resource intensive. Further, the Hawthorne effect could improve staff performance and increase their feeling of disturbance (Lopetegui et al., 2014). Two studies gathered data directly from the staff being studied (self-reported survey), which is considered least reliable (Lopetegui et al., 2014). No studies used time-action analysis of video records asynchronously. Among gold standards for workflow observations, video records are preferable because they are more thorough and comprehensive (Lopetegui et al., 2014).

The unit's cost of nursing staff time could be derived from information about the actual staff grade, gross salaries, and direct and indirect working time. Uplifting the observed direct working time with a load factor is a simple way to account for work time indirectly related to patient care (Beecham, 2000). None of the included studies applied a load factor for salary, which in general would result in an underestimation of the real costs (see Table 3).

The unit cost for consumables could be based on the hospital purchase price (excluding value-added taxes). Consumables and staff time were often calculated as an average of the local or national level of costs, which may be inaccurate and change over time.

Capital Cost

Many studies have considered the application of a microwave oven to warm the wipes. However, the cost of a decontaminator, microwave, and basin may depend on how they are used at different units. To establish unit cost, it is necessary to consider the purchase price, expected lifetime, and anticipated use during the lifetime. In addition, possible maintenance costs and time for cleaning should be considered. None of the studies included costs of capital goods or their service cost. The cost analysis may, therefore, underestimate the actual cost (Frick, 2009).

Both methods require the same space (the patient in the bed) for the bath, but there could be some increase in storage space (more single-use equipment), waste, and waste collection. Buildings and costs regarding water, electricity, and acquisitions were often determined as zero costs in the included studies (Buyukyilmaz & Şendir, 2017).

Consequences

Few of the nine studies included the costs of possible implications of using SAW and DWW, such as infections. SAW and DWW were assumed to be comparable for patients' physiological and health outcomes (Groven et al., 2017). There may be hygiene benefits in terms of less transportation of contaminated basins, less odor, and less mess with basins in the cleaning rooms.

Cost minimization analysis (CMA) (Dakin & Wordsworth, 2013) was used as a framework in most of the included studies because it measures and compares only costs of the intervention and comparator studied. However, the cost of bed baths should incorporate possible resource consequences related to changes in risk of infections and shorter length of stay based on an assessment of the difference in risk of infection and additional costs of treating the infection. CMA may introduce bias into uncertainty estimates and is only recommended if the difference in additional cost is not significant (Dakin & Wordsworth, 2013).

Study Limitations

The internal validity of this review was ensured by the application of a systematic methodology and by the involvement and aid from experienced research librarians regarding keyword and database identification.

All bed bath interventions were included, regardless of bathing methods or brands of consumables used. This was chosen due to the small number of studies and because researchers were only looking for variables for cost assessment. Notably, no studies of disposable molded cardboard basins were found, despite being avail-

able in some Danish wards.

Also, many of the studies were small scale and there was a great variety in their design, interventions, settings, countries, outcome, and how participants and data were included (e.g., age, diagnosis). In addition, the literature is primarily descriptive with little data on statistical variations, which makes it difficult to interpret with confidence and to conduct a meta-analysis (Groven et al., 2017). However, the high heterogeneity in reported outcomes may contribute to the development of a more comprehensive, comparable, and generic cost model.

Two studies employed a crossover design (Larson et al., 2004; Nøddeskou et al., 2015). Crossover design contributes to balanced assessments of the two bed bath methods because they were conducted in the same setting and with the same patient.

Identified cost variables were included, but there may be other relevant variables that were not found through the search, because of language limitations or the search terms used.

The classification of the studies for the cost analysis was based on the researchers' judgment, but there may be other ways of grouping them.

Cost analyses can be used in decision-making at the hospital where they were conducted because the bed bath methods were measured in the same context (unit/ward/guidelines/equipment). A possible next step for measuring time use could be workflow observations using video records (Drummond et al., 2015; Lopetegui et al., 2014).

Conclusion

There are many challenges in estimating costs of the different bed bath methods, and this scoping review identified great variation in costing methodologies and estimates of bed bath costs. Future development of generic cost models may provide theoretical support and a firmer foundation to the decision-making process to assess which bed bath methods are the most cost effective. The model should, at a minimum, include running costs and capital costs. $

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Acknowledgment: Thanks to Lorna Campbell for language editing.

Funding Support: Unrestricted funding was provided by The University of Southern Denmark, Region of Southern Denmark, University College South Denmark and Hospital of Southern Jutland.

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Supplementary file 2

	Eligibility criteria
	Inclusion
Population	All - no age limit and regardless of country, setting, demographic factors, disease, diagnosis and whether they require a bed bath or similar.
Concept	Traditional bed bath interventions using soap and water, regardless of utensils and guidelines. The equipment typically includes a basin, water, towels, washcloths and soap. Including all other bed bath interventions than soap and water not limited to any specific type, brand or content disinfections agents. The interventions typically comprise cloths, wipes or towels pre-moistened or with the addition of an evaporation no-rinse cleaner. Cost and resources use for bed baths from a hospital nursing management perspective
Context	All contexts

Note: Language limitation

Refrence: Peters, M.D., et al., *Guidance for conducting systematic scoping reviews.* International journal of evidence-based healthcare, 2015. **13**(3): p. 141-146.

Supplementary file 3

#	CINAHL
1	"wipe*" OR "basin*" OR "bowl*" OR "towel*" OR "washcloth*" OR (MH "Soaps") OR "soap*" OR (MH "Water") OR "water" OR "rinse-free" OR "disposable*" OR "prepackaged" OR "basinless"
2	(MH "Costs and Cost Analysis") OR "cost*" OR (MH "Economics") OR "economic*" OR (MH "Time and Motion Studies") OR "Time and motion" OR "time saving" OR timesaving
3	(MH "Bathing and Baths") OR "bath*" OR (MH "Hygiene") OR "hygien*" OR "clean*" OR "wash" OR "washing" OR "washes" OR (MH "Genitalia") OR "genitalia" OR "meatus" OR "meatal" OR "penile" OR "intimate" OR (MH "Perineal Care") OR "perineal" OR (MH "Urethra") OR "urethra" OR (MH "Perineum") OR "perineum"
4	#1 AND #2 AND #3

#	Cochrane
1	bath* OR hygiene* OR clean* OR wash OR washes OR washing OR genitalia OR meatal OR meatus OR penile OR intimate OR perineal OR urethral OR perineum
2	wipe* OR basin* OR bowl* OR towel* OR washcloth* OR soap* OR water OR rinse-free OR disposable OR prepackage* OR basinless
3	costs* OR economic OR timesaving OR time and motion OR time saving
4	#1 AND #2 AND #3

#	SCOPUS
1	((TITLE-ABS-KEY (cost) OR TITLE-ABS-KEY (economic) OR TITLE-ABS-KEY (money) OR TITLE-ABS-KEY (timesaving)))
2	((TITLE-ABS-KEY (washing) OR TITLE-ABS-KEY (washes) OR TITLE-ABS-KEY (wash*) OR TITLE-ABS-KEY (hygien*) OR TITLE-ABS-KEY (clean*) OR TITLE-ABS-KEY (genitalia) OR TITLE-ABS-KEY (meatal) OR TITLE-ABS-KEY (bath*) OR TITLE-ABS-KEY (towel*) OR TITLE-ABS-KEY (urethra) OR TITLE-ABS-KEY (penile) OR TITLE-ABS-KEY (perineum) OR TITLE-ABS-KEY (perineal) OR TITLE-ABS-KEY (intimate)))
3	((TITLE-ABS-KEY (wipe*) OR TITLE-ABS-KEY (basin*) OR TITLE-ABS-KEY (bowl*) OR TITLE-ABS-KEY (towel*) OR TITLE-ABS-KEY (washcloth*) OR TITLE-ABS-KEY (soap*) OR TITLE-ABS-KEY (disposable) OR TITLE-ABS-KEY (prepackaged) OR TITLE-ABS-KEY (basinless) OR TITLE-ABS-KEY (rinse W/1 free)))
4	((TITLE-ABS-KEY (patient*) OR TITLE-ABS-KEY (elderly) OR TITLE-ABS-KEY (aged) OR TITLE-ABS-KEY (homecare) OR TITLE-ABS-KEY (bedbound) OR TITLE-ABS-KEY (bedridden) OR TITLE-ABS-KEY (inpatient*) OR TITLE-ABS-KEY (nursing W/1 home) OR TITLE-ABS-KEY (primary W/1 health W/1 care) OR TITLE-ABS-KEY (hospitalized)))
5	#1 AND #2 AND #3 AND #

#	PubMed
1	(((bath* OR hygien* OR clean* OR wash OR washing OR washes OR genitalia OR meatal OR meatus OR penile intimate OR perineal OR urethra OR perineum)))
2	(((wipe* OR basin* OR bowl* OR washcloth* OR soap* OR water OR rinse-free OR disposable OR prepackaged OR basinless))) OR (((""Soaps""[Mesh]) OR ""Water""[Mesh])"
3	(((cost* OR economic* OR timesaving OR time saving OR time and motion))) OR (((""Costs and Cost Analysis""[Mesh]) OR ""Economics""[Mesh])"
4	((((patient* OR elderly OR aged OR homecare OR bed bound OR hospitalized OR bedridden OR inpatient OR nursing home)))) OR (((((""Patients""[Mesh]) OR ""Aged""[Mesh]) OR ""Inpatients""[Mesh]) OR ""Bedridden Persons""[Mesh]) OR ""Hospitalization""[Mesh])"
5	#1 AND #2 AND #3 AND #4

#	Embase
1	(hygiene or hygien* or bath* or bath or clean* or wash or washes or washing or practices* or genitalia Meatal or meatus or penile or intimate or perineal care or urethra or perineum mp
2	Cost* or cost or economic or timesaving or time saving or time and motion
3	Patient* or patient or elderly or aged or homecare or bedbound or bedridden or immobility or hospitalized or inpatient or hospital patient or inpatient or nursing home
4	Wipe* or basin* or bowl* or towel* or washcloth* or soap or soap* or (water and soap) or rinse free or disposable or prepackaged or basinless
5	#1 AND #2 AND #3 AND #4

Supplementary file 4

Load factor definition:
"*Direct client contact client related work ratio of direct to indirect time: on client related work*"

Load factor calculation
Estimated e.g. 75% time related to patient care and e.g. 25% related to other tasks

Directly time used for patient care e.g. 30 minutes X 1.25 = 37.5 minutes

Refernce: Beecham, J., *Unit costs: Not exactly child's play.* A guide to estimating unit costs for children's social care. University of Kent: Joint publication from the Department of Health, Dartington Social Research Unit and the Personal Social Services Research Unit, 2000.

ISSN (online): 2246-1302
ISBN (online): 978-87-7573-868-7

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