
**UNIVERSITI PUTRA MALAYSIA**

# *PRELIMINARY OUTCOMES OF A NEW PELVIC TRAINING APP AMONG INCONTINENT PREGNANT WOMEN ATTENDING CLINICS IN THE HULU LANGAT DISTRICT, SELANGOR, MALAYSIA*

**AIDA BINTI JAFFAR**

**FPSK(p) 2022 39**

# PRELIMINARY OUTCOMES OF A NEW PELVIC TRAINING APP AMONG INCONTINENT PREGNANT WOMEN ATTENDING CLINICS IN THE HULU LANGAT DISTRICT, SELANGOR, MALAYSIA

By

**AIDA BINTI JAFFAR**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

**July 2022**

## DEDICATION

This dissertation is dedicated to all women who have experienced urinary incontinence during pregnancy, significantly affecting their quality of life.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

**PRELIMINARY OUTCOMES OF A NEW PELVIC TRAINING APP AMONG INCONTINENT PREGNANT WOMEN ATTENDING CLINICS IN THE HULU LANGAT DISTRICT, SELANGOR, MALAYSIA**

By

**AIDA BINTI JAFFAR**

**July 2022**

**Chairman : Professor Datin Sherina Mohd Sidik, PhD**
**Faculty : Medicine and Health Sciences**

Pregnant women do experience difficulty controlling urine or urinary incontinence (UI). Kegel exercise or pelvic floor muscle training (PFMT) is recommended for its treatment. PFMT is when someone performs pelvic floor muscle exercise (PFME), according to the prescription by healthcare professionals. Despite advances in digital and mobile health apps, limited PFMT apps were evidence-based. Thus, this study proposed a PFMT mHealth app using the Capability, Opportunity, Motivational and Behaviour Model to assist in its adherence. This study aimed to develop and evaluate the preliminary outcomes of a PFMT app on knowledge, attitude, practice, self-efficacy, and adherence to PFMT among incontinent pregnant women attending a clinic in Hulu Langat district, Selangor.

The multiphase mixed methods design approach comprises three main phases were involved. In phase 1, two studies were conducted; (1) a cross-sectional study to determine the knowledge, attitude, and practices (KAP) of pelvic floor muscle exercise (PFME), the prevalence of UI and its quality of life (QOL) among pregnant women (N=440), through validated questionnaires (Knowledge, Attitude and Practice on PFME, Incontinence Questionnaire-Urinary Incontinence Short Form, and ICIQ-Lower Urinary Tract Symptoms Quality of Life, and (2) five focus group discussions (FGDs) to evaluate pregnant women's (N=24) preferred design for the app. In phase 2, two concurrent studies were performed to finalize the Kegel Exercise Pregnancy Training (KEPT) app prototype design. It consisted of usability studies from both incontinent pregnant women (N=5) and experts (N=4) using the Malay-mHealth App Usability Questionnaire (Malay-MAUQ), and mHealth App Usability Questionnaire (MAUQ). Finally, phase 3 involved a pilot randomized control trial (RCT) among incontinent pregnant women (N=26) to assess the preliminary outcomes of the

KEPT app, utilizing a few questionnaires, such as the Exercise Adherence Rating Scale, the Self-Efficacy Scale For Practicing Pelvic Floor Exercise Questionnaire, and the Malay-MAUQ, in addition to similar questionnaires as phase 1. The generalized estimating equation (GEE) was used to compare both groups' improvement scores.

Phase 1 indicated that the mean age of respondents was 29.8 years old (SD 4.69), with the prevalence of UI moderately high at 40.1% (95%CI: 2.04-2.70), and only 12.7% performed regular PFME. Stress UI, (OR 6.94, 95%CI 4.00–12.04) and urge UI (OR3.87, 95%CI 0.48–31.28) were significantly associated with negative QOL. Phase 2 demonstrated that the incontinent pregnant women evaluated the app's ease-of-use, interface and satisfaction, and usefulness with 5.52/7.0, 6.4/7.0, and 6.17/7.0, respectively, whereas the experts evaluated the app's ease-of-use, interface and satisfaction, and usefulness with 5.80/7.0, 5.57/7.0, and 5.83/7.0. Phase 3 reported a retention rate of 61.5%, and only attitude toward PFMT was significantly improved post-intervention ($\beta = 5.884$, $P = 0.034$), whilst the adherence towards PFMT scored with ($\beta = -2.910$, $P = 0.312$). They rated the KEPT app (interactive version) as being usable with system information arrangement (4.98/7.0), usefulness (4.89/7.0), and ease-of-use and satisfaction (5.03/7.0).

Therefore, the KEPT app has the potential to help pregnant women adhere to PFMT. Future research should identify the effectiveness of the KEPT app in achieving adherence to PFMT and improving its UI.

Keywords: Pelvic Floor Muscle Training, urinary incontinence, mHealth app, knowledge, attitude, practice, self-efficacy

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**PENGHASILAN AWAL APLIKASI LATIHAN PELVIK DI KALANGAN WANITA HAMIL MEMPUNYAI INKONTINEN URIN YANG MENGHADIRI KLINIK DI DAERAH HULU LANGAT, SELANGOR**

Oleh

**AIDA BINTI JAFFAR**

**Julai 2022**

**Pengerusi : Profesor Datin Sherina Mohd Sidik, PhD**
**Fakulti : Perubatan dan Sains Kesihatan**

Wanita hamil mengalami kesukaran mengawal air kencing atau inkontinen (UI) di mana senaman Kegel atau latihan otot lantai pelvik (PFMT) adalah disyorkan untuk merawatnya. PFMT ialah apabila seseorang melakukan senaman otot lantai pinggul (PFME), mengikut preskripsi oleh anggota kesihatan profesional. Walaupun terdapat kemajuan dalam aplikasi kesihatan digital dan mudah alih, aplikasi PFMT berasaskan bukti masih lagi terhad. Oleh itu, kajian ini mencadangkan aplikasi mHealth PFMT menggunakan model Keupayaan, Peluang, Motivasi dan Tingkah Laku (COM-B) untuk membantu pematuhannya. Kajian ini bertujuan untuk membangunkan dan menilai hasil awal prototaip aplikasi PFMT mengenai pengetahuan, sikap, amalan, efikasi kendiri, dan pematuhan kepada PFMT dalam kalangan wanita hamil yang mempunyai masalah inkontinen yang menghadiri klinik di daerah Hulu Langat, Selangor.

Pendekatan reka bentuk dengan menggunakan kaedah campuran berbilang fasa terdiri daripada tiga fasa yang terlibat. Dalam fasa 1, dua kajian telah dijalankan; (1) kajian keratan rentas untuk menentukan pengetahuan, sikap, dan amalan (KAP) senaman otot lantai pinggul (PFME), prevalens UI dan kualiti hidupnya di kalangan wanita hamil (N=440), melalui soal selidik yang disahkan (Pengetahuan, Sikap dan Amalan mengenai PFME, Soal Selidik Inkontinens-Inkontinens Kencing Bentuk Pendek, dan Kualiti Hidup Simptom Saluran Kencing Bawah ICIQ), dan (2) lima perbincangan kumpulan fokus (FGD) untuk menilai pilihan wanita hamil (N=24) berkenaan reka bentuk app tersebut. Dalam fasa 2, dua kajian serentak telah dilakukan untuk memastikan reka bentuk prototaip aplikasi Latihan Kehamilan Senaman Kegel (KEPT). Ia terdiri daripada kajian kebolehgunaan daripada wanita hamil yang mempunyai masalah inkontinen (N=5) dan pakar (N=4) menggunakan Soal Selidik Kebolehgunaan Aplikasi Malay-mHealth (Malay-MAUQ), dan Soal Selidik Kebolehgunaan

Aplikasi mHealth (MAUQ). Akhir sekali, fasa 3 melibatkan percubaan kawalan rawak perintis (RCT) dalam kalangan wanita hamil mempunyai masalah inkontinen (N=26) untuk menilai hasil awal daripada aplikasi KEPT, dengan menggunakan beberapa soal selidik, seperti Skala Penilaian Kepatuhan Latihan, Skala Keberkesanan Kendiri Untuk Mengamalkan Soal Selidik Latihan Lantai Pelvis, dan Malay-MAUQ, sebagai tambahan kepada soal selidik yang sama seperti fasa 1. Persamaan anggaran umum (GEE) digunakan untuk membuat perbandingan peningkatan skor dikedua-dua kumpulan.

Fasa 1 menunjukkan bahawa umur purata responden ialah 29.8 tahun dengan Standard Deviation (SD) = 4.69, dengan prevalens UI sederhana tinggi pada 40.1% (95%CI: 2.04,70), dan hanya 12.7% melakukan PFME biasa. Stress UI, (OR 6.94, 95%CI 4.00, 2.04) dan Urge UI (OR3.87, 95%CI 0.48, 1.28) dikaitkan secara signifikan dengan QOL yang negatif. Fasa 2 menunjukkan bahawa wanita hamil inkontinen menilai kemudahan penggunaan, antara muka dan kepuasan aplikasi serta kegunaan masing-masing dengan 5.52/7.0, 6.4/7.0 dan 6.17/7.0, manakala pakar menilai kemudahan penggunaan aplikasi itu, antara muka dan kepuasan, dan kegunaan dengan 5.80/7.0, 5.57/7.0 dan 5.83/7.0. Fasa 3 melaporkan kadar pengekalan sebanyak 61.5%, dan hanya sikap terhadap PFMT telah meningkat dengan ketara selepas intervensi $\beta = 5.884$, $P = 0.034$, manakala pematuhan terhadap PFMT mendapat skor dengan $\beta = -2.910$, $P = 0.312$. Mereka menilai aplikasi KEPT (versi interaktif) sebagai boleh digunakan dengan susunan maklumat sistem (4.98/7.0), kebergunaan (4.89/7.0), dan kemudahan penggunaan dan kepuasan (5.03/7.0).

Oleh itu, aplikasi KEPT berpotensi untuk membantu wanita hamil mematuhi PFMT. Penyelidikan masa depan perlu mengenal pasti keberkesanan aplikasi KEPT dalam mencapai pematuhan kepada PFMT dan menambah baik UI.

Kata kunci: Senaman otot lantai pelvik, inkontinens urin, aplikasi mobil, pengetahuan, amalan sikap, keyakinan diri

## ACKNOWLEDGEMENTS

This thesis is dedicated to my much-loved mother, who had endlessly supported this journey bio-psycho-socially. I would like to thank my mother-in-law, who has always been praying for me. To my siblings and colleagues, a few WhatsApp groups (Dr Tan Siew Tin, Dr Lai Wei Kent, Dr. Parwathi Alagirisamy, Dr Norashikin Mustaffa, and Dr Puteri Shanaz Binti Jahn Kassim) from the local universities and overseas have given me the energy and guidance in this journey, and to A/P Dr Tan Chai Eng had always supported me even before I started this journey.

I am grateful to have my husband, Masdi Hasan, who has been very loyal in providing everything in my wishlist to keep surviving on this journey and my children, who have been my strong supporters.

I want to express my sincere gratefulness to my supervisor, Professor Datin Dr Sherina bt Mohd Sidik, for empowering me to complete my PhD. My gratitude extends to the supervisory committee members Associate Professor Dr Rosliza Abdul Manaf, Dr Foo Chai Nien, Associate Professor Dr Noor Azimah Muhammad, and Dr Siti Irma Fadhilah Ismail for their kind guidance. To Dr Nazhatussima Suhaili and nurses in Klinik Kesihatan Ampang, “your contribution to this study is highly appreciated”. Additionally, I would like to express gratitude to the research assistants (Dr Prishalini, Dr Aziemah, and Dr Darshini).

My gratitude extends to the Universiti Putra Malaysia for the funding opportunity (Geran Putra Berimpak, UPM/800—3/3/1/GPB/2018/9668500) to undertake my studies at the Department of Psychiatry, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. Special thanks to my colleagues from Universiti Pertahanan Nasional Malaysia (especially my Primary Care Unit: Associate Professor Dr. Ambigga Devi S. Krishnapillai, Dr. Ng Kien Keat, Dr Maizatullifah binti Miskan and Datin Dr. Hasliza binti Abu Hassan), Universiti Kebangsaan Malaysia, and Universiti Putra Malaysia for your kind encouragement and support.

Finally, to all the participants of this study, thank you, for your support and the enumerators for your kind dedication in completing this project.

I certify that a Thesis Examination Committee has met on 22 July 2022 to conduct the final examination of Aida Jaffar on her thesis entitled “Preliminary Outcomes of a New Pelvic Training App among Incontinent Pregnant Women Attending Clinics in the Hulu Langat District, Selangor, Malaysia” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

Members of the Thesis Examination Committee were as follows:

**Kulanthayan K.C. Mani, PhD**
Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

**Salmiah binti Md Said, M Comm Med**
Associate Professor
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Internal Examiner)

**Noor Azah binti Abd Aziz, MPhil**
Professor
Faculty of Medicine
Universiti Kebangsaan Malaysia
(External Examiner)

**Nynke Scherpbier- De Haan, PhD**
Professor
Faculty of Medical Sciences
University of Gronigen
Netherlands
(External Examiner)

**SITI SALWA ABD GANI, PhD**
Associate Professor ChM. and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 22 September 2022

This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

**Datin Sherina binti Mohd Sidik, PhD**
Professor (Medical)
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Chairman)

**Rosliza binti Abdul Manaf, PhD**
Associate Professor (Medical)
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

**Siti Irma Fadhilah binti Ismail, PhD**
Senior Lecturer
Faculty of Medicine and Health Sciences
Universiti Putra Malaysia
(Member)

**Foo Chai Nien, PhD**
Assistant Professor
Faculty of Medicine and Health Sciences
Universiti Tuanku Abdul Rahman, Malaysia
(Member)

**Noor Azimah binti Muhammad, PhD**
Associate Professor
Faculty of Medicine
Universiti Kebangsaan Malaysia
(Member)

**ZALILAH MOHD SHARIFF, PhD**
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 10 November 2022

**Declaration by Members of Supervisory Committee**

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature: _____
Name of Chairman of Supervisory Committee: Professor Datin Dr. Sherina Mohd Sidik

Signature: _____
Name of Member of Supervisory Committee: Associate Professor Dr. Rosliza Abdul Manaf

Signature: _____
Name of Member of Supervisory Committee: Dr. Siti Irma Fadhilah Ismail

Signature: _____
Name of Member of Supervisory Committee: Associate Professor Dr. Foo Chai Nien

Signature: _____
Name of Member of Supervisory Committee: Associate Professor Dr. Noor Azimah Muhammad

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| BMI | Body Mass Index |
| CI | Confidence Interval |
| COM-B | Capability, Opportunity, Motivation – Behaviour |
| FGD | Focus group discussion |
| GEE | Generalized Estimating Equations |
| HCP | Healthcare provider |
| ICIQ-UI-SF | International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form |
| ICS | International Continence Society |
| IUGA | International Urogynecological Association |
| KAP | Knowledge, Attitude and Practice |
| KK | Klinik Kesihatan |
| mHealth | Mobile Health |
| mHealth app | Mobile Health Application |
| MOH | Ministry of Health |
| MUI | Mixed urinary incontinence |
| MYR | Malaysian Ringgit |
| NICE | National Institute for Health and Clinical Excellence |
| NIH | National Institute of Health Quality Assessment |
| PFME | Pelvic Floor Muscle Exercise |
| PFMT | Pelvic Floor Muscle Training |
| QOL | Quality of life |
| RA | Research assistant |
| RCT | Randomized Control Trial |

| | |
|---|---|
| SD | Standard Deviation |
| SESPPFE | Self-Efficacy Scale for Practicing Pelvic Floor Exercises |
| SPSS | Statistical package for the social science |
| SUI | Stress urinary incontinence |
| UI | Urinary incontinence |
| UUI | Urge urinary incontinence |
| WHO | World Health Organization |

# CHAPTER 1

# INTRODUCTION

This chapter discusses the study background, states the study motivation, defines the study problems, and justifies the significance of the study, research objectives, and hypothesis.

## 1.1 Background

Urinary incontinence (UI) is a common bladder health problem in women where the sufferer cannot hold urine voluntarily. UI can be divided into three common types: stress urinary incontinence, urge urinary incontinence, and mixed urinary incontinence, which associates with the first two (Abrams et al., 2017). Stress urinary incontinence (SUI), the commonest form of UI, is characterized by an involuntary loss of urine due to physical exertion, such as sneezing or coughing (Abrams et al., 2017).

UI occurred during pregnancy and post-partum (post-delivery) (Moossdorff-Steinhauser et al., 2021c). Many women experienced UI even during their first pregnancy, as reported by 38.7% of 860 nulliparous pregnant women in a multi-strand prospective cohort study (Daly et al., 2018). Another study demonstrated that primigravida with SUI has up to four-fold increased risks of developing SUI at 12 years postpartum (OR: 2.14; 95% CI: 1.29-3.55) (Arrue Gabilondo et al., 2021).

Several factors were involved, such as weakened pelvic floor muscles and hormonal changes. Stress UI occurs when the bladder pressure exceeds the urethral closure pressure due to the added weight of the gravid uterus (Sangsawang & Sangsawang, 2013). Pregnant women were inclined to keep their UI secret from the health care providers (HCP) since they perceived it as usually occurring during pregnancy and will disappear postpartum (Woodley & Hay-Smith, 2021). The HCP needs to correct their misperception and institute early management strategies to improve pelvic muscle strength. In order to strengthen the pelvic floor muscle, Kegel's exercise or pelvic floor muscle training (PFMT) was suggested by Dr Arnold Kegel (Kegel, 1948). Randomized controlled trials demonstrated that PFMT improved stress UI and mixed UI severity during pregnancy and postpartum and has been recommended in a few guidelines (Paul Abrams et al., 2018; NICE Guideline CG123, 2019; Woodley et al., 2020).

PFMT adherence implies performing voluntary contractions of the pelvic floor muscles (PFM) regularly, according to a prescribed protocol, and the duration of the training period. A Cochrane review highlighted that the PFMT programme usually comprises one or more daily exercises performed on at least several days of the week for at least eight weeks (Woodley et al., 2020). However, pregnant women must understand that UI is a medical problem, and PFMT can help them to prevent and improve their symptoms. After acquiring the correct information about UI, they will be able to have a positive attitude and correct practice in managing their symptoms. A systematic review was conducted to identify women's KAP related to urinary incontinence and reported that all articles (n=15) demonstrated misinformation about UI. Only one article (n=1/7) had a good attitude, and all articles (n=19) revealed low rates of seeking care (Bezerra et al., 2018). Hence, delayed help-seeking worsens their UI and affects their quality of life (Boutib et al., 2022) due to lack and interrupted nights of sleep and frequent urination.

In this country, the state healthcare system has been financed through government tax-based financing enabling public outpatient healthcare (primary care clinic) to provide MYR1 (estimated to be USD 0.22 in 2022) for each visit. However, a study reported that not all are willing to pay the cost per visit, even for acute or chronic illness, especially from the low socio-income group (Puteh et al., 2017). There are other added costs such as absent form work cost, transportation cost, in addition to the absorbent pad costs and costs of washing clothes. UI considerably impacted healthcare costs worldwide (Milsom et al., 2014; Milsom & Gyhagen, 2021). For example, the projected total healthcare cost for managing UI in the United States was $76.2 billion in 2015 and was predicted to increase to $82.6 billion in 2020, with 85% of the treatment cost for SUI (Coyne et al., 2014). Most of the patient's cost used pads with a mean cost of $1.69 per week, and almost half of them used laundry with a mean cost of $6.09 per week (L. L. Subak et al., 2006). They paid about $900 per year for routine incontinence care, especially for those with severe incontinence (L. L. Subak et al., 2006). The financial burden was apparent for the health and the patient's cost in managing UI.

PFMT was a cost-effective and valuable prevention and management option for UI in pregnancy. Individual PFMT during pregnancy only costs $768 to the health service to prevent one case of UI (Brennen et al., 2021) but needs an additional cost of $1202 to cure it in the postnatal period (Brennen et al., 2021). Hence, it is cost-effective to focus on preventing and managing UI during pregnancy to reduce the risk of developing UI during postpartum and menopause. Despite evidence on the usefulness of PFMT, pregnant women fail to adhere for several reasons. These include personal factors (e.g. unawareness of the importance of PFMT), healthcare providers' factors (reluctance to promote PFMT due to human resource and time constraints), and the nature of PFMT itself as it is time-consuming and adherence is required (Terry et al., 2020; Woodley & Hay-Smith, 2021). Thus, to improve pregnant women's UI symptoms, there is a need to overcome these barriers to educate and promote PFMT adherence.

A report from a pilot study conducted at the antenatal clinic in the tertiary hospital stated that only 51.8% of pregnant women had good knowledge of performing the exercise, with only 10.7% practising it (Rosediani et al., 2012). Another study highlighted that pregnant women believed that by performing PFMT, vaginal trauma could be reduced and facilitate delivery (Temtanakitpaisan et al., 2020). However, there was a limited study looking at the knowledge, attitude, practices (KAP), and adherence of PFMT at primary care clinics which need to be studied. Pregnant women in tertiary care in our urban area preferred to be taught and briefed on the importance of exercise and performed UI screening during antenatal follow-up by healthcare providers (Mohd Yusoff et al., 2019).

Fortunately, this country's mobile phone and internet access have improved, reaching a saturation point of 98.7% of users in 2020. Patients can access internet technologies and reach health care professionals using smartphones using mHealth apps. Mobile health, also known as mHealth, uses mobile and wireless technologies to take advantage of the rapid uptake of information and communication technologies (ICT) to improve health system efficiency and health outcomes (Agarwal et al., 2016). A cross-sectional study in Selangor, Malaysia, reported that the most common mHealth apps used were the multi-purpose, general health and fitness apps. Regarding the use pattern, about a third of the participants reported using their health apps daily to gain benefits by tracking health status (47%), receiving motivation (41%), and gaining knowledge about their health and fitness (9%). However, the main issues reported were the inaccuracy of the app (24%), inconvenience (20.7%), and not being user-friendly (18.5%) (Bhuvan et al., 2021).

As for pregnant women, there has been growing evidence for using mobile Health (mHealth) applications for self-monitoring, although evidence is still scarce (Asklund et al., 2017; Li et al., 2020; Wadensten et al., 2021). Intervention using mHealth apps was proposed for this study because smartphone ownership is very high among Malaysians due to its potential for improving accessibility and personalisation. According to the Tanahashi model, accessing the healthcare service is one of the determinants of ensuring the healthcare services reach the target population (Tanahashi, 1978).

## 1.2 Problem Statement

The prevalence of UI during pregnancy across Malaysia has been high, ranging from 34% to 65.8% over the past five years (Abdullah et al., 2016; Mohd Yusoff et al., 2019). This high prevalence is worrying as a longitudinal cohort study reported that SUI among primigravida doubled the risk (OR: 2.14; 95% CI: 1.29-3.55) of having UI in the subsequent 12 years (Arrue Gabilondo et al., 2021). Additionally, BMI (OR, 1.20; 95% CI, 1.14–1.27) and parity (OR, 1.46;95 % CI, 1.08–1.97) became significant factors for the cumulative incidence of UI. Unfortunately, despite this high prevalence, UI screening was not done during antenatal visits (Mohd Yusoff et al., 2019; Yeoh et al., 2016).

Hence, it is a public health concern that healthcare personnel does not screen pregnant women for UI. Furthermore, pregnant women are not seeking help for their UI due to their unawareness, although the condition is preventable and treatable (Soave et al., 2019; Woodley et al., 2020). The overall poor knowledge and practice of PFMT (Rosediani et al., 2012) warrant the emphasis on providing accurate PFMT information to prevent UI during their pregnancies and postpartum. The successful implementation of a PFMT awareness program has yet to be empirically studied in a primary care setting in Malaysia.

There are antenatal educational classes for pregnant women in Malaysia. A dedicated multidisciplinary team delivers various classes on labour, birth, parenthood, breastfeeding, postnatal care, exercises, and healthy eating. Before the COVID19 pandemic began, a physiotherapist regularly conducted weekend antenatal exercises among pregnant women from selected primary care clinics in Hulu Langat district, Selangor. PFMT was prescribed as part of the antenatal exercise. The physiotherapy team conducted the classes based on the Antenatal and Postnatal Exercise Manual developed by the Family Health Development Division, Ministry of Health Malaysia, MOH (Ministry of Health, 2014). However, during the pandemic COVID19, the antenatal exercise program had to be cancelled.

This further limits pregnant women's access to PFMT and its role in preventing and reducing UI symptoms (Woodley et al., 2020). Hence, pregnant women face various barriers, including time constraints, privacy concerns, and difficulty accessing the healthcare systems (Bayat et al., 2021; Mallett et al., 2018; Wagg et al., 2017). Mobile health technology may provide a potential solution for these barriers as they usually have handphones and internet accessibility.

Evidence in other countries has shown promising effects of using mobile applications to enable pregnant women to confidently perform daily PFMT with a reminder system, resulting in UI improvement (Araujo et al., 2020; Asklund et al., 2017; Nyström et al., 2018). Unfortunately, there is limited local evidence on the delivery of PFMT using mobile applications among pregnant women with UI in Malaysia. The available evidence from a systematic review of the available PFMT apps demonstrated poor credibility (Dantas et al., 2021) and quality (Ho et al., 2020) with a score of 2.9/5.0 by the Mobile Application Rating Scale (MARS), the quality. This could be due to the poorly-designed app without using the correct development framework. The behavioural change theories (Grace-Farfaglia, 2019; Kramer & Kowatsch, 2017), such as the Health Belief Model (Rosenstock, I. M., Strecher, V. J., & Becker, M. H., 1988), described that the ability to perceive the risk of untreated UI, and the Social Cognitive Theory whereby they had the ability in performing PFMT. These theories could guide the researchers and developers to tackle the specific behaviour changes in promoting PFMT adherence in pregnant women.

Additionally, usability features (Overdijkink et al., 2018) are essential to obtain the best possible results in ensuring user adherence and subsequent UI reduction. The persuasive systems design (Karppinen et al., 2016; Sporrel et al., 2021) is crucial to motivating patients to engage with the mHealth app. Therefore, the design and development process of a mHealth app would include needs assessment and its development and evaluation among target users, pregnant women. To the best knowledge, there is no local evidence on the delivery of PFMT using mobile applications among pregnant women with UI in Malaysia.

## 1.3 Significance of the Study

Although PFMT interventions were successfully implemented in developed countries, it is still limited in the primary care setting in Malaysia. With the current pandemic COVID19 situation, the restriction of movement and social distancing measures resulted in more barriers to meeting physiotherapists. Therefore, using mobile technology in the e-health era is much warranted. As such, the findings of this study will lead to the development of a theory-based mHealth app, which may be integrated into our local antenatal e-health services in future. Concurrently, the present study may benefit pregnant women by improving their PFMT knowledge, attitude, practice, and adherence to self-efficacy enhancement. Hopefully, this newly developed mHealth app will improve their continence status and quality of life.

The software development life cycle (SDLC) is a systematic software or system development method that aims to complete a project in a timely manner while producing a high-quality, reliable, and cost-effective product. SDLC provides activities or steps that primarily guide system architects and developers in software development (Mishra & Dubey, 2013). Iterative software development life cycle (SDLC) is one of the most preferred process models for developing an effective and high-quality software product (Sen et al., 2021) and mobile health app (Barra et al., 2017). The process carries on the specification, implementation, and validation activities concurrently to quickly produce an initial version of the software system that can then be refined through iterations.

The use of an iterative approach in conjunction with the mHealth development and evaluation process is recognized. Hence, mHealth Development and Evaluation Framework was introduced (Jacobs & Graham, 2016; Whittaker et al., 2012), stressing an iterative approach to refining mHealth interventions. The framework relies on concurrent and sequential qualitative and quantitative research with the target users and focuses on disseminating research findings throughout the development process. The iteration was intended to ensure the development of the app has its potential to be useful and acceptable to pregnant women

If successful, it is hoped the app can be expanded to provide other aspects of antenatal care, such as other antenatal exercises and nutrition advice. Pregnant women experiencing time limitations and social restrictions to attend their antenatal clinic physically may benefit from using this app. The app may enhance the sustainability of antenatal care according to our national strategies in achieving the second pillar of the 11th Malaysia Plan (Improving wellbeing for all) and the 3rd goal (Good health and wellbeing) from the Sustainable Development Goals by the United Nations (Economic Planning Unit, 2015; Nunes et al., 2016).

## 1.4 Research Questions

This study focuses on answering three research questions:

1. What is the quality of life of pregnant women with and without UI and their prevalence of knowledge, attitude, and practice of PFMT in a primary care clinic in Selangor?
2. How to design and develop a PFMT mHealth app prototype for incontinent pregnant women in the primary care setting?
3. Does the PFMT mHealth app prototype demonstrate preliminary outcomes in improving adherence, knowledge, attitude, practices and self-efficacy to PFMT and the severity of UI and quality of life among incontinent pregnant women?

## 1.5 Aims and Objectives

### 1.5.1 Aims of the Study

A1. Develop a mHealth application for pregnant women with UI
A2. Assess the feasibility and its preliminary effectiveness of the newly developed app.

### 1.5.2 General Objective

The general objective of this study was to develop and evaluate the preliminary outcomes of a PFMT mHealth app prototype on knowledge, attitude, practice, self-efficacy, and adherence to PFMT among incontinent pregnant women attending a clinic in Hulu Langat district, Selangor.

### 1.5.3 Specific Objectives

The specific objectives of the study have been developed to achieve the aims stated above:

1. To perform the need assessment for the mHealth app by studying the associations of urinary incontinence and its quality of life, PFMT knowledge, attitude, and practice, among pregnant women in health clinic Kajang, Hulu Langat, Selangor, Malaysia.
2. To design, develop and validate the PFMT mHealth app for pregnant women with urinary incontinence attending a health clinic in Hulu Langat, Selangor, Malaysia.
3. To assess the feasibility and evaluate the preliminary outcomes of a PFMT app on knowledge, attitude, practice, self-efficacy, and adherence to PFMT among incontinent pregnant women attending a clinic in Hulu Langat district, Selangor

### 1.5.4 Research Hypotheses

1. There is no significant association between the quality of life, socio-demographics, and clinical and obstetric characteristics on the prevalence of UI among pregnant women attending a clinic in Hulu Langat district, Selangor.
2. There is no significant association in the knowledge, attitude, and practice of PFMT with the severity of UI symptoms and the quality of life of the respondents in the incontinent and continent groups.
3. There is no significant difference in the socio-demographic characteristics, clinical and obstetric characteristics, and outcome measures of PFMT knowledge, attitude, practice, self-efficacy, adherence, the severity of a urinary symptom, and the quality of life of the respondents between the intervention and control group.

## 1.6 Outline and Structure of the Thesis

This thesis is presented in eight chapters divided into six discrete sections: introduction, literature review, methodology, four published articles, and conclusions (Figure 1.1). Chapter 2 explore the literature review of urinary incontinence, pelvic floor muscle training facilitation and barriers among pregnant women. This review aimed to identify the interventions available to improve PFMT adherence and develop the conceptual framework to initiate and engage with mHealth as the research intervention. Chapter 3 presents the research process and the methodology of this thesis. A critical realist

epistemological orientation underpins this research and influences the research strategy.

Chapters 4 to 7 are presented in the form of published articles. Chapter 4 describes the needs assessment findings in the app development, such as the poor quality of life associated with certain types of UI. It was based on a cross-sectional study which was conducted at a primary health care clinic. Findings from Chapter 4 motivate and justify the importance of PFMT mHealth app prototype development. Chapter 5 elaborates on the validation process in developing the PFMT mHealth app prototype. This validation process involved findings from a cross-sectional study and focus group discussion (FGDs), which assisted the developer and researcher in designing and developing the app, known as the Kegel Exercise Pregnancy Training app (KEPT app). It discussed the app's development process that was derived from initial requirement driven the user-centred incorporated in the iterative process model, from which the mHealth framework was developed, which include six stages: (1) conceptualization; (2) formative research; (3) pre-testing; (4) pilot testing; (5) randomized controlled trial; and (6) qualitative research, before escalating to more comprehensive intervention.

Chapter 6 highlights the usability evaluation of the app from the experts'. The expert usability evaluation consisted of four experts assessments using three evaluations; (1) cognitive walkthrough - which utilizes accurately detailed procedures to simulate a user's problem-solving process at each step, (2) heuristic evaluation - to detect user interface problems cost-effectively, and (3) usability testing (mHealth App Usability Questionnaire) – to assess the usability of a mHealth app which has three domains focusing on the ease of use, interface and satisfaction, and usefulness of the app. The findings from a pilot feasibility randomised controlled trials (RCT) designed to test the preliminary outcomes of the KEPT app prototype in a primary health care clinic in Hulu Langat district, Selangor, are reported in Chapter 7. Finally, Chapter 8 provides a synthesizing and summary discussion of various research components concerning the research aims and objectives. Additionally, the specific contributions to knowledge, the mHealth app development and tools for assessment, and future practice were highlighted.

## 1.7 Summary

The development of this PFMT mHealth app may benefit healthcare providers: especially primary care doctors, staff nurses, and physiotherapists in Malaysia. They can use this PFMT mHealth app to support and empower pregnant women to self-monitor and self-manage without attending PFMT antenatal education classes. Additionally, this intervention will enable physiotherapists to disseminate evidence-based PFMT information via this mHealth app designed from behavioural change theory.

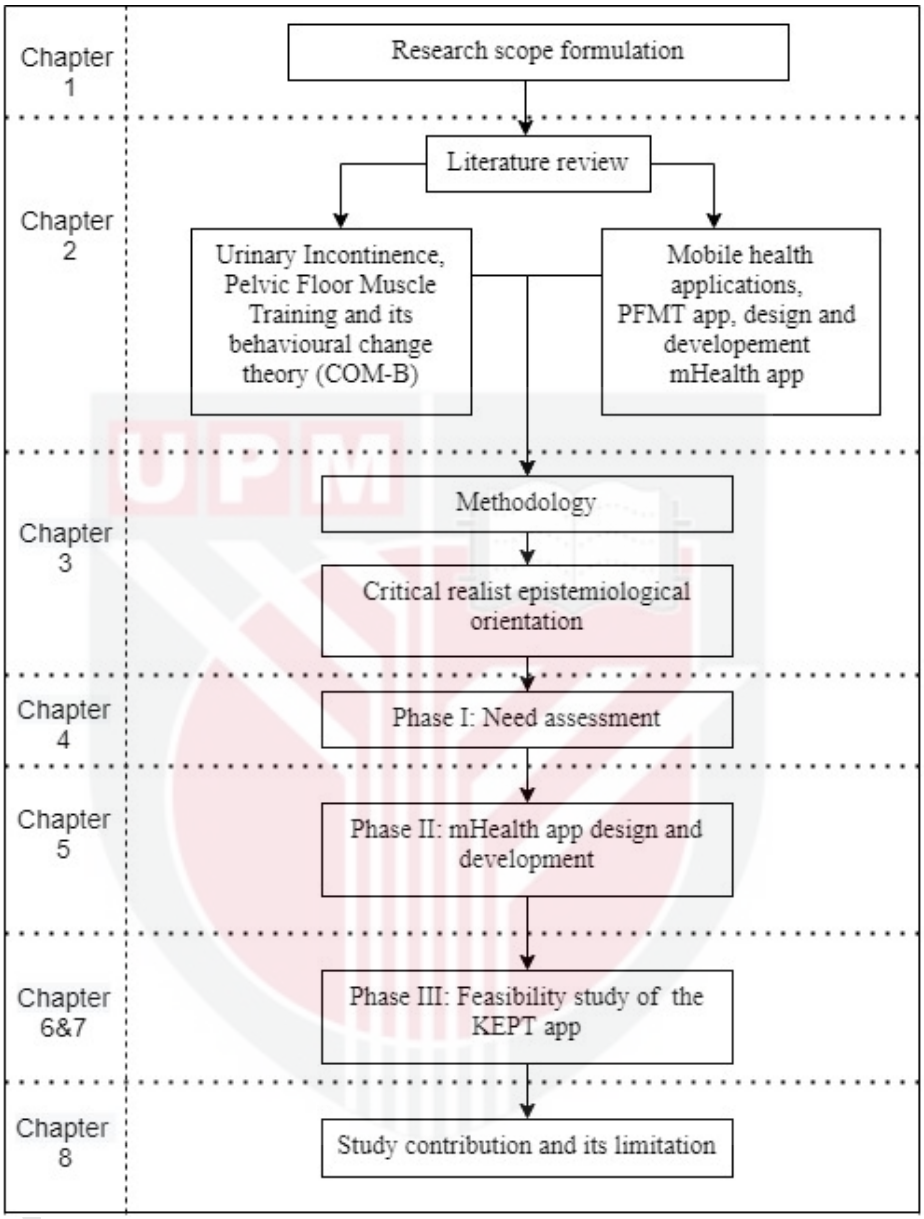


**Figure 1.1 : Thesis overview progression**

## REFERENCES


Abbott, J. H. (2014). The Distinction between Randomized Clinical Trials (RCTs) and Preliminary Feasibility and Pilot Studies: What They Are and Are Not. *Journal of Orthopaedic and Sports Physical Therapy*, *44*(8), 555–558. https://doi.org/10.2519/jospt.2014.0110

Abdullah, B., Ayub, S. H., Mohd Zahid, A. Z., Noorneza, A. R., Isa, M. R., & Ng, P. Y. (2016). Urinary incontinence in primigravida: the neglected pregnancy predicament. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *198*, 110–115. https://doi.org/10.1016/j.ejogrb.2016.01.006

Abrams, P, Cardozo, L., Wagg, A., & Wein, A. (2017). Incontinence 6th Edition ICI-ICS. *International Continence Society, Bristol UK*.

Abrams, Paul, Andersson, K., Apostolidis, A., Birder, L., Bliss, D., Brubaker, L., Cardozo, L., Castro-Diaz, D., O'connell, P. R., & Cottenden, A. (2018). 6th International Consultation on Incontinence. Recommendations of the International Scientific Committee: evaluation and treatment of urinary incontinence, pelvic organ prolapse and faecal incontinence. *Neurourology and Urodynamics*, *37*(7), 2271–2272.

Abrams, Paul, Cardozo, L., Wagg, A., & Wein, A. (2017). 6th International Consultation on Continence. *Incontinence. 6th International Consultation on Incontinence, Tokyo, September 2016*, *September 2016*, 1–142. Retrieved from: https://www.ics.org/publications/ici_6/Incontinence_6th_Edition_2017_eBook_v2.pdf

Abu-Bader, S. H. (2021). *Using statistical methods in social science research: With a complete SPSS guide*. Oxford University Press, USA.

Agarwal, S., Lefevre, A. E., Lee, J., L'engle, K., Mehl, G., Sinha, C., Labrique, A., Vasudevan, L., Tamrat, T., Kallander, K., Mitchell, M., Aziz, M. A., Froen, F., Ormel, H., Muniz, M., & Asangansi, I. (2016). Guidelines for reporting of health interventions using mobile phones: Mobile health (mHealth) Evidence reporting and assessment (mERA) checklist. *BMJ (Online)*, *352*, 1–10. https://doi.org/10.1136/bmj.i1174

Åhlund, S., Nordgren, B., Wilander, E.-L., Wiklund, I., & Fridén, C. (2013). Is home-based pelvic floor muscle training effective in treatment of urinary incontinence after birth in primiparous women? A randomized controlled trial. *Acta Obstetricia et Gynecologica Scandinavica*, *92*(8), 909–915. https://doi.org/10.1111/AOGS.12173

Ahmad, D. (2019). Enhancing sustainability in healthcare delivery-A challenge to the New Malaysia. *Malaysian Journal of Medical Sciences*, *26*(1), 1–4. https://doi.org/10.21315/mjms2019.26.1.1

Ajzen, I. (2011). The theory of planned behaviour: Reactions and reflections. *Psychology and Health*, *26*(9), 1113–1127. https://doi.org/10.1080/08870446.2011.613995

Akmal Muhamat, N., Hasan, R., Saddki, N., Mohd Arshad, M. R., & Ahmad, M. (2021). Development and usability testing of mobile application on diet and oral health. *PLOS ONE*, *16*(9), e0257035. https://doi.org/10.1371/journal.pone.0257035

Al Kiyumi, M. H., Al Belushi, Z. I., Jaju, S., & Al Mahrezi, A. M. (2020). Urinary Incontinence Among Omani Women: Prevalence, risk factors and impact on quality of life. *Sultan Qaboos University Medical Journal*, *20*(1), e45–e53. https://doi.org/10.18295/squmj.2020.20.01.007

Alagirisamy, P., & Mohd Sidik, S. (2020). *Pelvic Floor Muscle Exercises during and after Pregnancy*. Universiti Putra Malaysia Press Serdang.

Alagirisamy, P., Sidik, S. M., Rampal, L., & Ismail, S. I. F. (2022). Effectiveness of a Pelvic Floor Muscle Exercise Intervention in Improving Knowledge, Attitude, Practice, and Self-Efficacy among Pregnant Women: A Randomized Controlled Trial. *Korean Journal of Family Medicine*, *43*(1), 42–55. https://doi.org/10.4082/kjfm.21.0011

Ali, S. H., Foreman, J., Capasso, A., Jones, A. M., Tozan, Y., & Diclemente, R. J. (2020). Social media as a recruitment platform for a nationwide online survey of COVID-19 knowledge, beliefs, and practices in the United States: Methodology and feasibility analysis. *BMC Medical Research Methodology*, *20*(1), 1–11. https://doi.org/10.1186/s12874-020-01011-0

Andaya, B. W., & Andaya, L. Y. (2016). *A history of Malaysia*. Macmillan International Higher Education.

Anderson, M. R., Salisbury, A. L., Uebelacker, L. A., Abrantes, A. M., & Battle, C. L. (2022). Stress, coping and silver linings: How depressed perinatal women experienced the COVID-19 pandemic. *Journal of Affective Disorders*, *298*(PA), 329–336. https://doi.org/10.1016/j.jad.2021.10.116

Andrade, C. (2021). The Inconvenient Truth About Convenience and Purposive Samples. *Indian Journal of Psychological Medicine*, *43*(1), 86–88. https://doi.org/10.1177/0253717620977000

Araujo, C. C., Marques, A. de A., & Juliato, C. R. T. (2020). The Adherence of Home Pelvic Floor Muscles Training Using a Mobile Device Application for Women With Urinary Incontinence: A Randomized Controlled Trial. *Female Pelvic Medicine & Reconstructive Surgery*, *26*(11), 697–703. https://doi.org/10.1097/SPV.0000000000000670

Arrue Gabilondo, M., Ginto, L., Zubikarai, M., Galán, C., Saro, J., & Diez-Itza, I. (2021). Risk factors associated with stress urinary incontinence 12 years after first delivery. *International Urogynecology Journal*. https://doi.org/10.1007/s00192-020-04661-2

Ashton-Miller, J. A., & DeLancey, J. O. L. (2021). *Mechanisms of Pelvic Floor Trauma During Vaginal Delivery BT - Pelvic Floor Disorders: A Multidisciplinary Textbook* (G. A. Santoro, A. P. Wieczorek, & A. H. Sultan (eds.); pp. 189–209). Springer International Publishing. https://doi.org/10.1007/978-3-030-40862-6_12

Asklund, I., Nyström, E., Sjöström, M., Umefjord, G., Stenlund, H., & Samuelsson, E. (2017). Mobile app for treatment of stress urinary incontinence: A randomized controlled trial. *Neurourology and Urodynamics*. https://doi.org/10.1002/nau.23116

Asklund, I., Samuelsson, E., Hamberg, K., Umefjord, G., & Sjöström, M. (2019). User Experience of an App-Based Treatment for Stress Urinary Incontinence: Qualitative Interview Study. *Journal of Medical Internet Research*, *21*(3), e11296. https://doi.org/10.2196/11296

Aune, D., Mahamat-Saleh, Y., Norat, T., & Riboli, E. (2019). Body mass index, abdominal fatness, weight gain and the risk of urinary incontinence: a systematic review and dose–response meta-analysis of prospective studies. *BJOG: An International Journal of Obstetrics and Gynaecology*, *126*(12), 1424–1433. https://doi.org/10.1111/1471-0528.15897

Avery, K., Donovan, J., Peters, T. J., Shaw, C., Gotoh, M., & Abrams, P. (2004). ICIQ: A brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *Neurourology and Urodynamics*, *23*(4), 322–330. https://doi.org/10.1002/nau.20041

Baharuddin, R., Singh, D., & Razali, R. (2013). Usability dimensions for mobile applications-a review. *Res. J. Appl. Sci. Eng. Technol*, *5*(6), 2225–2231.

Balalau, D., Olaru, O., Bacalbasa, N., Paunica, S., Balan, D., & Stanescu, A. (2021). The analysis of risk factors associated with women's urinary incontinence; literature review. *Journal of Mind and Medical Sciences*, *8*(1), 53–59. https://doi.org/10.22543/7674.81.p5359

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215.

Bandura, Albert. (1986). Social foundations of thought and action: A social cognitive theory. In *Social foundations of thought and action: A social cognitive theory.* Prentice-Hall, Inc.

Barakat, R., Pelaez, M., Montejo, R., Luaces, M., & Zakynthinaki, M. (2011). Exercise during pregnancy improves maternal health perception: a randomized controlled trial. *American Journal of Obstetrics and Gynecology*, *204*(5), 402.e1-402.e7. https://doi.org/10.1016/J.AJOG.2011.01.043

Barbosa, L., Boaviagem, A., Moretti, E., & Lemos, A. (2018). Multiparity, age and overweight/obesity as risk factors for urinary incontinence in pregnancy: a systematic review and meta-analysis. *International Urogynecology Journal*, *29*(10), 1413–1427. https://doi.org/10.1007/s00192-018-3656-9

Barbosa, L., Kühni, D., Vasconcelos, D., Sales, E., Lima, G., Santos, M., & Lemos, A. (2018). Factors Associated with Urinary Incontinence in Pregnant Adolescents: A Case-Control Study. *Journal of Pediatric and Adolescent Gynecology*. https://doi.org/10.1016/j.jpag.2018.02.131

Barca, J. A., Bravo, C., Pintado-Recarte, M. P., Asúnsolo, Á., Cueto-Hernández, I., Ruiz-Labarta, J., Buján, J., Ortega, M. A., & De León-Luis, J. A. (2021). Pelvic Floor Morbidity Following Vaginal Delivery versus Cesarean Delivery: Systematic Review and Meta-Analysis. *Journal of Clinical Medicine*, *10*(8), 1652. https://doi.org/10.3390/jcm10081652

Barnum, C. M. (2020). *Usability testing essentials: ready, set... test!* (Second Edi). Morgan Kaufmann.

Barra, D. C. C., Paim, S. M. S., Sasso, G. T. M. D., & Colla, G. W. (2017). Methods for developing mobile apps in health: an integrative review of the literature. *Texto & Contexto-Enfermagem*, *26(4):e2260017*.

Bartholomew, L. K. ., Parcel, G. S., Kok, G., Gottlieb, N. H., & Fernandez, M. E. (2016). *Planning health promotion programs: an intervention mapping approach* (Third Ed). John Wiley & Sons.

Bayat, M., Eshraghi, N., Naeiji, Z., & Fathi, M. (2021). Evaluation of Awareness, Adherence, and Barriers of Pelvic Floor Muscle Training in Pregnant Women: A Cross-sectional Study. *Female Pelvic Medicine & Reconstructive Surgery*, *27*(1), e122–e126. https://doi.org/10.1097/SPV.0000000000000852

Beauchemin, M., Gradilla, M., Baik, D., Cho, H., & Schnall, R. (2019). A Multi-step Usability Evaluation of a Self-Management App to Support Medication Adherence in Persons Living with Hiv. *International Journal of Medical Informatics*, *122* (August 2018), 37–44. https://doi.org/10.1016/j.ijmedinf.2018.11.012

Bekele, A., Adefris, M., & Demeke, S. (2016). Urinary incontinence among pregnant women, following antenatal care at University of Gondar Hospital, North West Ethiopia. *BMC Pregnancy and Childbirth*, *16*(1), 333. https://doi.org/10.1186/s12884-016-1126-2

Berhe, A., Alamer, A., Negash, K., & Assefa, B. (2020). Urinary incontinence and associated factors among pregnant women attending antenatal care in public health facilities of Mekelle city, Tigray, Ethiopia. *Women's Health*, *16*. https://doi.org/10.1177/1745506520952009

Bezerra, L. R. P. S., Vasconcelos Neto, J. A., Vasconcelos, C. T. M., Saboia, D. M., Oriá, M. O. B., & Firmiano, M. L. V. (2018). Women's knowledge, attitude and practice related to urinary incontinence: systematic review. *International Urogynecology Journal*. https://doi.org/10.1007/s00192-018-3759-3

Bhuvan, K. C., Alrasheedy, A. A., Goh, B. H., Blebil, A., Bangash, N. S. A., Ibrahim, M. I. M., & Rehman, I. U. (2021). The types and pattern of use of mobile health applications among the general population: A cross-sectional study from Selangor, Malaysia. *Patient Preference and Adherence*, *15*, 1755–1762. https://doi.org/10.2147/PPA.S325851

Billingham, S. A., Whitehead, A. L., & Julious, S. A. (2013). An audit of sample sizes for pilot and feasibility trials being undertaken in the United Kingdom registered in the United Kingdom Clinical Research Network database. *BMC Medical Research Methodology*, *13*(1), 1. https://doi.org/10.1186/1471-2288-13-104

Binyamin, S. S., & Zafar, B. A. (2021). Proposing a mobile apps acceptance model for users in the health area: A systematic literature review and meta-analysis. *Health Informatics Journal*, *27*(1), 1460458220976737. https://doi.org/10.1177/1460458220976737

Bø, K. (2012). Pelvic floor muscle training in treatment of female stress urinary incontinence, pelvic organ prolapse and sexual dysfunction. *World Journal of Urology*, *30*(4), 437–443. https://doi.org/10.1007/s00345-011-0779-8

Bø, K. (2020). Physiotherapy management of urinary incontinence in females. *Journal of Physiotherapy*, *66*(3), 147–154. https://doi.org/10.1016/j.jphys.2020.06.011

Bo, K., Berghmans, B., Morkved, S., & Van Kampen, M. (2014). *Evidence-Based physical therapy for the pelvic floor-E-book: bridging science and clinical practice* (Second ed). Elsevier Health Sciences.

Bø, K., & Haakstad, L. A. H. (2011). Is pelvic floor muscle training effective when taught in a general fitness class in pregnancy? A randomised controlled trial. *Physiotherapy*. https://doi.org/ 10.1016/j.physio.2010.08.014

Bø, K., Pauck Øglund, G., Sletner, L., Mørkrid, K., & Jenum, A. K. (2012). The prevalence of urinary incontinence in pregnancy among a multi-ethnic population resident in Norway. *BJOG: An International Journal of Obstetrics & Gynaecology*, *119*(11), 1354–1360.

Borello-France, D., Burgio, K. L., Goode, P. S., Ye, W., Weidner, A. C., Lukacz, E. S., Jelovsek, J.-E., Bradley, C. S., Schaffer, J., Hsu, Y., Kenton, K., Spino, C. & Pelvic Floor Disorders Network (2013). Adherence to Behavioral Interventions for Stress Incontinence: Rates, Barriers, and Predictors. *Physical therapy, 93(6),* 757–773. https://doi.org/10.2522/ptj.20120072

Boutib, A., Chergaoui, S., Marfak, A., Hilali, A., & Youlyouz-Marfak, I. (2022). Quality of Life During Pregnancy from 2011 to 2021: Systematic Review. *International Journal of Women's Health*, *Volume 14*(May), 975–1005. https://doi.org/10.2147/IJWH.S361643

Braekken, I. H., Majida, M., Engh, M. E., & BØ, K. (2009). Test-retest reliability of pelvic floor muscle contraction measured by 4D ultrasound. *Neurourology and Urodynamics*, *28*(1), 68–73. https://doi.org/10.1002/nau.20618

Brawley, L. R., & Culos-Reed, S. N. (2000). Studying Adherence to Therapeutic Regimens. *Controlled Clinical Trials*, *21*(5), S156–S163. https://doi.org/10.1016/S0197-2456(00)00073-8

Brennen, R., Frawley, H. C., Martin, J., & Haines, T. P. (2021). Group-based pelvic floor muscle training for all women during pregnancy is more cost-effective than postnatal training for women with urinary incontinence: cost-effectiveness analysis of a systematic review. *Journal of Physiotherapy*, *67*(2), 105–114. https://doi.org/10.1016/j.jphys.2021.03.001

Brooke, J. (1996). Sus: a "quick and dirty'usability. *Usability Evaluation in Industry*, *189*.

Bruinse, H. W., van der Vaart, C. H., van Brummen, H. J., van de Pol, G., & Heintz, A. P. M. (2007). Is there an association between depressive and urinary symptoms during and after pregnancy? *International Urogynecology Journal*. https://doi.org/10.1007/s00192-007-0371-3

Burton, C. S., Gonzalez, G., Vaculik, K., Khalil, C., Zektser, Y., Arnold, C., Almario, C. V., Spiegel, B. M. R., & Anger, J. T. (2021). Female Lower Urinary Tract Symptom Prevention and Treatment Strategies on Social Media: Mixed Correlation With Evidence. *Urology*, *150*, 139–145. https://doi.org/10.1016/j.urology.2020.06.056

Calou, C. G. P., de Oliveira, M. F., Carvalho, F. H. C., Soares, P. R. A. L., Bezerra, R. A., de Lima, S. K. M., Antezana, F. J., de Souza Aquino, P., Castro, R. C. M. B., & Pinheiro, A. K. B. (2018). Maternal predictors related to quality of life in pregnant women in the Northeast of Brazil. *Health and Quality of Life Outcomes*, *16*(1), 109. https://doi.org/10.1186/s12955-018-0917-8

Cannon, S., Lastella, M., Vincze, L., Vandelanotte, C., & Hayman, M. (2020). A review of pregnancy information on nutrition, physical activity and sleep websites. *Women and Birth*, *33*(1), 35–40. https://doi.org/10.1016/j.wombi.2018.12.007

Carroll, J. K., Moorhead, A., Bond, R., LeBlanc, W. G., Petrella, R. J., & Fiscella, K. (2017). Who uses mobile phone health apps and does use matter? A secondary data analytics approach. *Journal of Medical Internet Research*, *19*(4), e125. https://doi.org/10.2196/jmir.5604

Carter, J., Sandall, J., Shennan, A. H., & Tribe, R. M. (2019). Mobile phone apps for clinical decision support in pregnancy: a scoping review. *BMC Medical Informatics and Decision Making*, *19*(1), 1–13. https://doi.org/10.1186/s12911-019-0954-1

Caruso, F. B., Schreiner, L., Todescatto, A. D., Crivelatti, I., & Oliveira, J. M. De. (2020). Risk Factors for Urinary Incontinence in Pregnancy: A Case Control Study. *Revista Brasileira de Ginecologia e Obstetricia*, *42*(12), 787–792. https://doi.org/10.1055/s-0040-1718951

Chang, S.-R., Lin, W.-A., Chang, T.-C., Lin, H.-H., Lee, C.-N., & Lin, M.-I. (2021). Risk factors for stress and urge urinary incontinence during pregnancy and the first year postpartum: a prospective longitudinal study. *International Urogynecology Journal*. https://doi.org/10.1007/s00192-021-04788-w

Chen, W., Chan, T. W., Wong, L. H., Looi, C. K., Liao, C. C. Y., Cheng, H. N. H., Wong, S. L., Mason, J., So, H. J., Murthy, S., Gu, X., & Pi, Z. (2020). IDC theory: habit and the habit loop. *Research and Practice in Technology Enhanced Learning*, *15*(1). https://doi.org/10.1186/s41039-020-00127-7

Chen, X., Wang, Y., Tao, D., Jiang, L., & Li, S. (2021). Antecedents of smartphone multitasking: roles of demographics, personalities and motivations. *Internet Research*, *31*(4), 1405–1443. https://doi.org/10.1108/INTR-09-2019-0388

Chen, Z., Wang, X., Jin, Y., & Feng, S. (2021). Knowledge, attitude and practice of pelvic floor dysfunction among obstetrical healthcare workers in China: A cross-sectional study. *Journal of Gynecology Obstetrics and Human Reproduction*, *50*(8), 102068. https://doi.org/10.1016/j.jogoh.2021.102068

Clinical Research APPS. (2017). *RRApp Robust Randomization App (Version 3.0.1)[Website application software]*. Retrieved from: https://clinicalresearch-apps.com/RRApp.html

Cooper, C. L., Whitehead, A., Pottrill, E., Julious, S. A., & Walters, S. J. (2018). Are pilot trials useful for predicting randomisation and attrition rates in definitive studies: A review of publicly funded trials. *Clinical Trials*, *15*(2), 189–196. https://doi.org/10.1177/1740774517752113

Cornet, V. P., Toscos, T., Bolchini, D., Rohani Ghahari, R., Ahmed, R., Daley, C., Mirro, M. J., & Holden, R. J. (2020). Untold Stories in User-Centered Design of Mobile Health: Practical Challenges and Strategies Learned From the Design and Evaluation of an App for Older Adults With Heart Failure. *JMIR MHealth and UHealth*, *8*(7), e17703. https://doi.org/10.2196/17703

Coyne, K. S., Wein, A., Nicholson, S., Kvasz, M., Chen, C., & Milsom, I. (2014). Economic Burden of Urgency Urinary Incontinence. *Academy of Managed Care Pharmacy*, *20*(2), 130–140. https://doi.org/10.18553/jmcp.2014.20.2.130

Cresswell, J.W., & Plano Clark, V. L. (2007). *Designing and conducting mixed method research*. Thousand Oaks: Sage.

Cruz, C., Riesco, M. L., & Zanetti, M. (2014). Supervised pelvic floor muscle training to treat urinary incontinence during pregnancy: A randomized controlled trial. *Neurourology and Urodynamics*, *33*(6), 867–868. https://doi.org/10.1002/nau.22655

Daly, D., Carroll, M., Barros, M., & Begley, C. (2019). Stop, think, reflect, realize—first-time mothers' views on taking part in longitudinal maternal health research. *Health Expectations*, *22*(3), 415–425. https://doi.org/10.1111/hex.12861

Daly, D., Clarke, M., & Begley, C. (2018). Urinary incontinence in nulliparous women before and during pregnancy: prevalence, incidence, type, and risk factors. *International Urogynecology Journal*, *29*(3), 353–362. https://doi.org/10.1007/s00192-018-3554-1

Dansharif, A. R., Iyawa, G. E., Owoseni, A., & Iyawa, R. (2021). mHealth for Self-Management in Pregnancy: Perceptions of Women in Low-Resource Settings. *Procedia Computer Science*, *181*(2019), 738–745. https://doi.org/10.1016/j.procs.2021.01.226

Dantas, L. O., Carvalho, C., Santos, B. L. de J., Ferreira, C. H. J., Bø, K., & Driusso, P. (2021). Mobile health technologies for the management of urinary incontinence: A systematic review of online stores in Brazil. *Brazilian Journal of Physical Therapy*, *xxxx*. https://doi.org/10.1016/j.bjpt.2021.01.001

Day, S. J., & Altman, D. G. (2000). Statistics notes: blinding in clinical trials and other studies. *BMJ (Clinical Research Ed.)*, *321*(7259), 504. https://doi.org/10.1136/bmj.321.7259.504

De Oliveira, C., Seleme, M., Cansi, P. F., Consentino, R. F. D. C., Kumakura, F. Y., Moreira, G. A., & Berghmans, B. (2013). Urinary incontinence in pregnant women and its relation with socio-demographic variables and quality of life. *Revista Da Associacao Medica Brasileira*. https://doi.org/10.1016/j.ramb.2013.08.002

de Vasconcelos, V. S., & da Costa, A. A. R. (2021). Frequency and Factors Associated with Urinary Incontinence in Pregnant Adolescents: A Cross-Sectional Study. *Journal of Pediatric and Adolescent Gynecology*, *34*(3), 366–376. https://doi.org/10.1016/j.jpag.2020.12.013

Department of Statistics Malaysia. (2019a). *Pocket Stats Pahang Quarter 3 2019*. Retrieved from: https://www.dosm.gov.my/

Department of Statistics Malaysia. (2019b). *Pocket Stats Selangor Quarter 3 2019*. https://www.dosm.gov.my/

Department of Statistics Malaysia. (2019c). *Pocket Stats Wilayah Persekutuan Quarter 3 2019*. Retrieved from: https://www.dosm.gov.my/

Department of Statistics Malaysia. (2020a). *Pocket Stats Quarter 1 2020*. Retrieved from: https://www.dosm.gov.my/

Department of Statistics Malaysia. (2020b). *Pocket Stats Selangor Quarter 1 2020*. Retrieved from: https://www.dosm.gov.my/

Diez-Itza, I., Zubikarai, M., Galan, C., Ginto, L., Saro, J., & Arrue, M. (2020). Factors involved in the persistence of stress urinary incontinence from postpartum to 12 years after first delivery. *Neurourology and Urodynamics*, *39*(6), 1849–1855. https://doi.org/10.1002/nau.24442

Dinc, A., Kizilkaya Beji, N., & Yalcin, O. (2009). Effect of pelvic floor muscle exercises in the treatment of urinary incontinence during pregnancy and the postpartum period. *International Urogynecology Journal*, *20*(10), 1223–1231. https://doi.org/10.1007/s00192-009-0929-3

Dorey, G., Glazener, C., Buckley, B., Cochran, C., & Moore, K. (2009). Developing a pelvic floor muscle training regimen for use in a trial intervention. *Physiotherapy*, *95*(3), 199–208. https://doi.org/10.1016/j.physio.2009.03.003

Du, Y., Xu, L., Ding, L., Wang, Y., & Wang, Z. (2015). The effect of antenatal pelvic floor muscle training on labor and delivery outcomes: a systematic review with meta-analysis. *International Urogynecology Journal*, *26*(10), 1415–1427. https://doi.org/10.1007/s00192-015-2654-4

Dumoulin, C., Hay-Smith, J., Frawley, H., McClurg, D., Alewijnse, D., Bo, K., Burgio, K., Chen, S.-Y., Chiarelli, P., Dean, S., Hagen, S., Herbert, J., Mahfooza, A., Mair, F., Stark, D., & Van Kampen, M. (2015). 2014 consensus statement on improving pelvic floor muscle training adherence: International Continence Society 2011 State-of-the-Science Seminar. *Neurourology and Urodynamics*, *34*(7), 600–605. https://doi.org/10.1002/nau.22796

Dumoulin, C., Lemieux, M.-C., Bourbonnais, D., Gravel, D., Bravo, G., & Morin, M. (2004). Physiotherapy for Persistent Postnatal Stress Urinary Incontinence: A Randomized Controlled Trial. *Obstetrics & Gynecology*, *104*(3), 504–510. https://doi.org/10.1097/01.AOG.0000135274.92416.62

Economic Planning Unit. (2015). 11th Malaysia Plan (2016-2020). *Prime Minister's Department, Malaysia*. Retrieved from: https://www.epu.gov.my/en/economic-developments/

Eldridge, S. M., Chan, C. L., Campbell, M. J., Bond, C. M., Hopewell, S., Thabane, L., Lancaster, G. A., & group, P. consensus. (2016). CONSORT 2010 statement: extension to randomised pilot and feasibility trials. *BMJ (Clinical Research Ed.)*, *355*, i5239–i5239. https://doi.org/10.1136/bmj.i5239

Erkal Aksoy, Y., Akın, B., & Dereli Yılmaz, S. (2021). Urinary incontinence experiences of pregnant women: A qualitative study. *Urologia Journal*, *88*(2), 140–147. https://doi.org/10.1177/0391560320974880

Falah-Hassani, K., Reeves, J., Shiri, R., Hickling, D., & McLean, L. (2021). The pathophysiology of stress urinary incontinence: a systematic review and meta-analysis. *International Urogynecology Journal*, *32*(3), 501–552. https://doi.org/10.1007/s00192-020-04622-9

Fernandez, M. E., Ruiter, R. A. C., Markham, C. M., & Kok, G. (2019). Intervention Mapping: Theory- and Evidence-Based Health Promotion Program Planning: Perspective and Examples. *Frontiers in Public Health*, *7*(AUG). https://doi.org/10.3389/fpubh.2019.00209

Ferrari, A., Bonciani, M., Russo, E., Mannella, P., Simoncini, T., & Vainieri, M. (2022). Patient-reported outcome measures for pregnancy-related urinary and fecal incontinence: A prospective cohort study in a large Italian population. *International Journal of Gynecology & Obstetrics*, *January 2021*, 1–9.https://doi.org/10.1002/ijgo.14132

Firet, L., Teunissen, T. A. M., Kool, R. B., van Doorn, L., Aourag, M., Lagro-Janssen, A. L. M., & Assendelft, W. J. J. (2021). Women's adoption of a web-based intervention for stress urinary incontinence: a qualitative study. *BMC Health Services Research*, *21*(1), 574. https://doi.org/10.1186/s12913-021-06585-z

Franko, O. (2012). Validate an App: How to Design Your Study and Get Published. *Journal of Mobile Technology in Medicine*, 1–4. https://doi.org/10.7309/jmtm.9

Fritel, X. (2015). Should we systematically ask about postnatal incontinence? In *BJOG: An International Journal of Obstetrics and Gynaecology*. https://doi.org/10.1111/1471-0528.13037

Garnett, C., Crane, D., West, R., Brown, J., & Michie, S. (2015). Identification of Behavior Change Techniques and Engagement Strategies to Design a Smartphone App to Reduce Alcohol Consumption Using a Formal Consensus Method. *JMIR MHealth and UHealth*, *3*(2), 1–9. https://doi.org/10.2196/mhealth.3895

Gillard, S., & Shamley, D. (2010). Factors motivating women to commence and adhere to pelvic floor muscle exercises following a perineal tear at delivery: The influence of experience. *Journal of the Association of Chartered Physiotherapists in Women's Health*, *106*, 5–18.

Glazener, C. M. A., Herbison, G. P., Wilson, P. D., MacArthur, C., Lang, G. D., Gee, H., & Grant, A. M. (2001). Conservative management of persistent postnatal urinary and faecal incontinence: randomised controlled. *BMJ*, *323*(7313), 593–593. https://doi.org/10.1136/bmj.323.7313.593

Gorbea Chávez, V., Velázquez Sánchez, M. del P., & Kunhardt Rasch, J. R. (2004). [Effect of pelvic floor exercise during pregnancy and puerperium on prevention of urinary stress incontinence]. *Ginecologia y obstetricia de Mexico*, *72*, 628–636.

Grace-Farfaglia, P. (2019). Social cognitive theories and electronic health design: Scoping review. *JMIR Human Factors*, *6*(3), 1–21. https://doi.org/10.2196/11544

Grant, A., & Currie, S. (2020). Qualitative exploration of the acceptability of a postnatal pelvic floor muscle training intervention to prevent urinary incontinence. *BMC Women's Health*, *20*. https://doi.org/10.1186/s12905-019-0878-z

Green, L. W., & Marshall, W. (2005). *Kreuter: Health Program Planning: An educational and ecological approach*. MC Graw Hill companies.

Habib, M., Sohail, I., & Khan, M. A. (2018). Are Home Based Pelvic Floor Muscle Exercises (PFMES) Effective in Prevention of Stress Urinary Incontinence During Pregnancy? A Randomized Controlled Trial. *National Journal of Health Sciences*, *3*(1), 23–26. https://doi.org/10.21089/njhs.31.0023

Hadizadeh-Talasaz, Z., Sadeghi, R., & Khadivzadeh, T. (2019). Effect of pelvic floor muscle training on postpartum sexual function and quality of life: A systematic review and meta-analysis of clinical trials. *Taiwanese Journal of Obstetrics and Gynecology*, *58*(6), 737–747. https://doi.org/10.1016/j.tjog.2019.09.003

Hage-Fransen, M. A. H., Wiezer, M., Otto, A., Wieffer-Platvoet, M. S., Slotman, M. H., Nijhuis-van der Sanden, M. W. G., & Pool-Goudzwaard, A. L. (2021). Pregnancy- and obstetric-related risk factors for urinary incontinence, fecal incontinence, or pelvic organ prolapse later in life: A systematic review and meta-analysis. *Acta Obstetricia et Gynecologica Scandinavica*, *100*(3), 373–382. https://doi.org/10.1111/aogs.14027

Hagger, M. S. (2019). Habit and physical activity: Theoretical advances, practical implications, and agenda for future research. *Psychology of Sport and Exercise*, *42*(September), 118–129. https://doi.org/10.1016/j.psychsport.2018.12.007

Hägglund, D., & Wadensten, B. (2007). Fear of humiliation inhibits women's care-seeking behaviour for long-term urinary incontinence. *Scandinavian Journal of Caring Sciences*, *21*(3), 305–312. https://doi.org/10.1111/j.1471-6712.2007.00481.x

Haines, K. J., & Berney, S. (2020). Physiotherapists during COVID-19: usual business, in unusual times. *Journal of Physiotherapy*, *66*(2), 67–69. https://doi.org/10.1016/j.jphys.2020.03.012

Hampel, C., Artibani, W., Espuña Pons, M., Haab, F., Jackson, S., Romero, J., Gavart, S., & Papanicolaou, S. (2004). Understanding the burden of stress urinary incontinence in Europe: A qualitative review of the literature. In *European Urology*. https://doi.org/10.1016/j.eururo.2004.02.003

Harjumaa, M., & Oinas-Kukkonen, H. (2007). *Persuasion Theories and IT Design BT - Persuasive Technology* (Y. de Kort, W. IJsselsteijn, C. Midden, B. Eggen, & B. J. Fogg (eds.); pp. 311–314). Springer Berlin Heidelberg.

Hauser-Ulrich, S., Künzli, H., Meier-Peterhans, D., & Kowatsch, T. (2020). A Smartphone-Based Health Care Chatbot to Promote Self-Management of Chronic Pain (SELMA): Pilot Randomized Controlled Trial. *JMIR Mhealth Uhealth*, *8*(4), e15806. https://doi.org/10.2196/15806

Hay-Smith, J., Dean, S., Burgio, K., McClurg, D., Frawley, H., & Dumoulin, C. (2015). Pelvic-floor-muscle-training adherence "modifiers": A review of primary qualitative studies- 2011 ICS State-of-the-Science Seminar research paper III of IV. *Neurourology and Urodynamics*, *34*(7), 622–631. https://doi.org/10.1002/nau.22771

Haylen, B. T., de Ridder, D., Freeman, R. M., Swift, S. E., Berghmans, B., Lee, J., Monga, A., Petri, E., Rizk, D. E., Sand, P. K., & Schaer, G. N. (2010). An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *International Urogynecology Journal*, *21*(1), 5–26. https://doi.org/10.1007/s00192-009-0976-9

Hazel, C. A., Bull, S., Greenwell, E., Bunik, M., Puma, J., & Perraillon, M. (2021). Systematic review of cost-effectiveness analysis of behavior change communication apps: Assessment of key methods. *Digital Health*, *7*, 205520762110005. https://doi.org/10.1177/20552076211000559

Hertzog, M. A. (2008). Considerations in determining sample size for pilot studies. *Research in Nursing & Health*, *31*(2), 180–191. https://doi.org/10.1002/nur.20247

Hilde, G., & Bø, K. (2015). The Pelvic Floor During Pregnancy and after Childbirth, and the Effect of Pelvic Floor Muscle Training on Urinary Incontinence - A Literature Review. Current Women`s Health Reviews, *11*, 19–30. https://doi.org/10.2174/1573404811011509142010 55

Hill, A. M., McPhail, S. M., Wilson, J. M., & Berlach, R. G. (2017). Pregnant women's awareness, knowledge and beliefs about pelvic floor muscles: a cross-sectional survey. *International Urogynecology Journal*. https://doi.org/10.1007/s00192-017-3309-4

Ho, L., Macnab, A., Matsubara, Y., Peterson, K., Tsang, B., & Stothers, L. (2020). Rating of Pelvic Floor Muscle Training Mobile Applications for Treatment of Urinary Incontinence in Women. *Urology*, 1–7. https://doi.org/10.1016/j.urology.2020.08.040

Hoffman, V., Söderström, L., & Samuelsson, E. (2017). Self-management of stress urinary incontinence via a mobile app: two-year follow-up of a randomized controlled trial. *Acta Obstetricia et Gynecologica Scandinavica*, *96*(10), 1180–1187. https://doi.org/10.1111/aogs.13192

Højberg, K.-E., Salvig, J. D., Winsløw, N. A., Lose, G., & Secher, N. J. (1999). Urinary incontinence: prevalence and risk factors at 16 weeks of gestation. *BJOG: An International Journal of Obstetrics & Gynaecology*, *106*(8), 842–850. https://doi.org/10.1111/j.1471-0528.1999.tb08407.x

Holzinger, A., Searle, G., Kleinberger, T., Seffah, A., & Javahery, H. (2008). *Investigating Usability Metrics for the Design and Development of Applications for the Elderly BT - Computers Helping People with Special Needs* (K. Miesenberger, J. Klaus, W. Zagler, & A. Karshmer (eds.); pp. 98–105). Springer Berlin Heidelberg.

Hornbæk, K., & Law, E. L.-C. (2007). Meta-analysis of correlations among usability measures. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 617–626.

Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (Vol. 398). John Wiley & Sons.

Hutchesson, M. J., Taylor, R., Shrewsbury, V. A., Vincze, L., Campbell, L. E., Callister, R., Park, F., Schumacher, T. L., & Collins, C. E. (2020). Be healthe for your heart: A pilot randomized controlled trial evaluating a web-based behavioral intervention to improve the cardiovascular health of women with a history of preeclampsia. *International Journal of Environmental Research and Public Health*, *17*(16), 1–18. https://doi.org/10.3390/ijerph17165779

IBM. Corp., & SPSS, I. B. M. (2018). IBM Statistical Package for Social Services (Version 25). *Seattle, WA: IBM*.

Inal, Y., Wake, J. D., Guribye, F., & Nordgreen, T. (2020). Usability evaluations of mobile mental health technologies: Systematic review. *Journal of Medical Internet Research*, *22*(1), 1–19. https://doi.org/10.2196/15337

International Organization for Standardization. (1998). *ISO 9241-11:* Ergonomic requirements for office work with visual display terminals (VDTs): *Part 11: Guidance on Usability.* https://doi.org/10.3403/01822507

Iribarren, S. J., Akande, T. O., Kamp, K. J., Barry, D., Kader, Y. G., & Suelzer, E. (2021). Effectiveness of Mobile Apps to Promote Health and Manage Disease: Systematic Review and Meta-analysis of Randomized Controlled Trials. *JMIR MHealth and UHealth*, *9*(1), e21563. https://doi.org/10.2196/21563

Ismail, S. I. M. F. (2009). An audit of NICE guidelines on antenatal pelvic floor exercises. *International Urogynecology Journal*, *20*(12), 1417–1422. https://doi.org/10.1007/s00192-009-0967-x

Iyawa, G. E., Dansharif, A. R., & Khan, A. (2021). Mobile apps for self-management in pregnancy: a systematic review. *Health and Technology*, *11*(2), 283–294. https://doi.org/10.1007/s12553-021-00523-z

Jacobs, M. A., & Graham, A. L. (2016). Iterative development and evaluation methods of mHealth behavior change interventions. *Current Opinion in Psychology*, *9*, 33–37. https://doi.org/10.1016/j.copsyc.2015.09.001

Jacomo, R. H., Nascimento, T. R., Lucena da Siva, M., Salata, M. C., Alves, A. T., da Cruz, P. R. C., & Batista de Sousa, J. (2020). Exercise regimens other than pelvic floor muscle training cannot increase pelvic muscle strength-a systematic review. *Journal of Bodywork and Movement Therapies*, *24*(4), 568–574. https://doi.org/10.1016/j.jbmt.2020.08.005

Jaffar, A., Mohd-Sidik, S., Abd Manaf, R., Foo, C. N., Gan, Q. F., & Saad, H. (2021a). Quality of life among pregnant women with urinary incontinence: A cross-sectional study in a Malaysian primary care clinic. *PLOS ONE*, *16*(4), e0250714. https://doi.org/10.1371/journal.pone.0250714

Jaffar, A., Mohd-Sidik, S., Foo, C. N., Admodisastro, N., Abdul Salam, S. N., & Ismail, N. D. (2022a). Improving Pelvic Floor Muscle Training Adherence Among Pregnant Women: Validation Study. *JMIR Human Factors*, *9*(1), e30989. https://doi.org/10.2196/30989

Jaffar, A., Mohd-Sidik, S., Nien, F. C., Fu, G. Q., & Talib, N. H. (2020). Urinary incontinence and its association with pelvic floor muscle exercise among pregnant women attending a primary care clinic in Selangor, Malaysia. *PLOS ONE*, *15*(7), e0236140. https://doi.org/10.1371/journal.pone.0236140

Jaffar, A., Mohd Sidik, S., Foo, C. N., Muhammad, N. A., Abdul Manaf, R., Fadhilah Ismail, S. I., & Suhaili, N. (2021b). Protocol of a Single-Blind Two-Arm (Waitlist Control) Parallel-Group Randomised Controlled Pilot Feasibility Study for mHealth App among Incontinent Pregnant Women. *International Journal of Environmental Research and Public Health*, *18*(9), 4792. https://doi.org/10.3390/ijerph18094792

Jaffar, A., Sidik, S. M., Admodisastro, N., Mansor, E. I., & Fong, L. C. (2021c). Expert's Usability Evaluation of the Pelvic Floor Muscle Training mHealth App for Pregnant Women. *International Journal of Advanced Computer Science and Applications*, *12*(10), 165–173. https://doi.org/10.14569/IJACSA.2021.0121019

Jaffar, A., Sidik, S. M., Foo, C. N., Muhammad, N. A., Manaf, R. A., & Suhaili, N. (2022b). Preliminary Effectiveness of mHealth App-Based Pelvic Floor Muscle Training among Pregnant Women to Improve Their Exercise Adherence : A Pilot Randomised Control Trial. *International Journal of Environmental Research and Public Health*, *19*(4). https://doi.org/10.3390/ijerph19042332

Jaffar, A., Tan, C.-E., Mohd-Sidik, S., Admodisastro, N., & Goodyear-Smith, F. (2022c). Persuasive Technology in an mHealth App Designed for Pelvic Floor Muscle Training Among Women: Systematic Review. *JMIR MHealth and UHealth*, *10*(3), e28751. https://doi.org/10.2196/28751

Jake-Schoffman, D. E., Silfee, V. J., Waring, M. E., Boudreaux, E. D., Sadasivam, R. S., Mullen, S. P., Carey, J. L., Hayes, R. B., Ding, E. Y., Bennett, G. G., & Pagoto, S. L. (2017). Methods for evaluating the content, usability, and efficacy of commercial mobile health apps. *JMIR MHealth and UHealth*, *5*(12). https://doi.org/10.2196/mhealth.8758

Johannessen, H. H., Stafne, S. N., Falk, R. S., Stordahl, A., Wibe, A., & Mørkved, S. (2018). Prevalence and predictors of double incontinence 1 year after first delivery. *International Urogynecology Journal*, *29*(10), 1529–1535. https://doi.org/10.1007/s00192-018-3577-7

Jose, R., Subramanian, S., Augustine, P., Rengaswamy, S., Nujum, Z., Gopal, B., Saroji, V., Samadasi, R., John, S., Narendran, M., Lal, A., & Pillai, R. (2022). Design and Process of Implementation Mobile Application Based Modular Training on Early Detection of Cancers (M-OncoEd) for Primary Care Physicians in India. *Asian Pacific Journal of Cancer Prevention*, *23*(3), 937–946. https://doi.org/10.31557/APJCP.2022.23.3.937

Julious, S. A. (2005). Sample size of 12 per group rule of thumb for a pilot study. *Pharmaceutical Statistics*, *4*(4), 287–291. https://doi.org/10.1002/pst.185

Jurášková, M., Piler, P., Kukla, L., Švancara, J., Daňsová, P., Hruban, L., Kandrnal, V., & Pikhart, H. (2020). Association between Stress Urinary Incontinence and Depressive Symptoms after Birth: the Czech ELSPAC Study. *Scientific Reports*, *10*. https://doi.org/10.1038/s41598-020-62589-5

Kang, G., Lee, H., Shin, M., Kim, J., Lee, S., & Park, Y. (2021). The efficacy of pilates on urinary incontinence in Korean women: A metabolomics approach. *Metabolites*, *11*(2), 1–18. https://doi.org/10.3390/metabo11020118

Karppinen, P., Oinas-Kukkonen, H., Alahäivälä, T., Jokelainen, T., Keränen, A.-M., Salonurmi, T., & Savolainen, M. (2016). Persuasive user experiences of a health Behavior Change Support System: A 12-month study for prevention of metabolic syndrome. *International Journal of Medical Informatics*, *96*, 51–61. https://doi.org/10.1016/j.ijmedinf.2016.02.005

Kay, M., Santos, J., & Takane, M. (2011). mHealth: New horizons for health through mobile technologies. *World Health Organization*, *64*(7), 66–71.

Kegel, A. H. (1948). Progressive resistance exercise in the functional restoration of the perineal muscles. *American Journal of Obstetrics and Gynecology*. https://doi.org/10.1016/0002-9378(48)90266-X

Kelleher, C. J., Cardozo, L. D., Khullar, V., & Salvatore, S. (1997). A new questionnaire to assess the quality of life of urinary incontinent women. *BJOG: An International Journal of Obstetrics and Gynaecology*, *104*(12), 1374–1379. https://doi.org/10.1111/j.1471-0528.1997.tb11006.x

Khoong, E. C., Olazo, K., Rivadeneira, N. A., Thatipelli, S., Barr-Walker, J., Fontil, V., Lyles, C. R., & Sarkar, U. (2021). Mobile health strategies for blood pressure self-management in urban populations with digital barriers: systematic review and meta-analyses. *Npj Digital Medicine*, *4*(1), 114. https://doi.org/10.1038/s41746-021-00486-5

Khowaja, K., & Al-Thani, D. (2020). New Checklist for the Heuristic Evaluation of mHealth Apps (HE4EH): Development and Usability Study. *JMIR MHealth and UHealth*, *8*(10), e20353. https://doi.org/10.2196/20353

Kim, H.-Y. (2013). Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. *Restorative Dentistry & Endodontics*, *38*(1), 52. https://doi.org/10.5395/rde.2013.38.1.52

Kim, S., & Baek, T. H. (2018). Examining the antecedents and consequences of mobile app engagement. *Telematics and Informatics*, *35*(1), 148–158. https://doi.org/10.1016/j.tele.2017.10.008

Kinouchi, K., & Ohashi, K. (2018). Smartphone-based reminder system to promote pelvic floor muscle training for the management of postnatal urinary incontinence: historical control study with propensity score-matched analysis. *PeerJ*, *6*, e4372–e4372. https://doi.org/10.7717/peerj.4372

Kish, L. (1965). *Survey sampling*. John Wiley.

Klovning, A., Avery, K., Sandvik, H., & Hunskaar, S. (2009). Comparison of two questionnaires for assessing the severity of urinary incontinence: The ICIQ-UI SF versus the incontinence severity index. *Neurourology and Urodynamics*, *28*(5), 411–415. https://doi.org/10.1002/nau.20674

Ko, P. C., Liang, C. C., Chang, S. D., Lee, J. T., Chao, A. S., & Cheng, P. J. (2011). A randomized controlled trial of antenatal pelvic floor exercises to prevent and treat urinary incontinence. *International Urogynecology Journal*, *22*(1), 17–22. https://doi.org/10.1007/s00192-010-1248-4

Kocaöz, S., Eroglu, K., & Sivaslioglu, A. A. (2013). Role of Pelvic Floor Muscle Exercises in the Prevention of Stress Urinary Incontinence during Pregnancy and the Postpartum Period. *Gynecologic and Obstetric Investigation*, *75*(1), 34–40. https://doi.org/10.1159/000343038

Kocaöz, S., Talas, M. S., & Atabekoğlu, C. S. (2010). Urinary incontinence in pregnant women and their quality of life. *Journal of Clinical Nursing*. https://doi.org/10.1111/j.1365-2702.2010.03421.x

Kok, G., Schaalma, H., Ruiter, R. A. C., Van Empelen, P., & Brug, J. (2004). Intervention Mapping: A Protocol for Applying Health Psychology Theory to Prevention Programmes. *Journal of Health Psychology*, *9*(1), 85–98. https://doi.org/10.1177/1359105304038379

Kramer, J. N., & Kowatsch, T. (2017). Using feedback to promote physical activity: The role of the feedback sign. *Journal of Medical Internet Research*, *19*(6), 1–11. https://doi.org/10.2196/jmir.7012

Kumar, B. A., & Goundar, M. S. (2019). Usability heuristics for mobile learning applications. *Education and Information Technologies*, *24*(2), 1819–1833. https://doi.org/10.1007/s10639-019-09860-z

Kumar, B. A., & Mohite, P. (2016). Usability guideline for mobile learning apps: an empirical study. *International Journal of Mobile Learning and Organisation*, *10*(4), 223. https://doi.org/10.1504/IJMLO.2016.079499

Lagadec, N., Steinecker, M., Kapassi, A., Magnier, A. M., Chastang, J., Robert, S., Gaouaou, N., & Ibanez, G. (2018). Factors influencing the quality of life of pregnant women: a systematic review. *BMC Pregnancy and Childbirth*, *18*(1), 455. https://doi.org/10.1186/s12884-018-2087-4

Latorre, G. F. S., de Fraga, R., Seleme, M. R., Mueller, C. V., & Berghmans, B. (2019). An ideal e-health system for pelvic floor muscle training adherence: Systematic review. *Neurourology and Urodynamics*, *38*(1), 63–80. https://doi.org/10.1002/nau.23835

Laura, G., Gianfranco, L., & Donatella, G. (2010). Pelvic floor muscle training during pregnancy to prevent urinary pelvic floor dysfunctions. *Neurourology and Urodynamics*, *29*, 64–65.

Lee, A. M., Chavez, S., Bian, J., Thompson, L. A., Gurka, M. J., Williamson, V. G., & Modave, F. (2019). Efficacy and Effectiveness of Mobile Health Technologies for Facilitating Physical Activity in Adolescents: Scoping Review. *JMIR Mhealth Uhealth*, *7*(2), e11847. https://doi.org/10.2196/11847

Leon, A. C., Davis, L. L., & Kraemer, H. C. (2011). The role and interpretation of pilot studies in clinical research. *Journal of Psychiatric Research*, *45*(5), 626–629. https://doi.org/10.1016/j.jpsychires.2010.10.008

Leventhal, H., Meyer, D., Nerenz, D., & Rachman, S. (1980). Contributions to medical psychology. *Contributions to Medical Psychology*, *17*, 30.

Lewis, J. R. (1992). Psychometric Evaluation of the Post-Study System Usability Questionnaire: The PSSUQ. *Proceedings of the Human Factors Society Annual Meeting*, *36*(16), 1259–1260. https://doi.org/10.1177/154193129203601617

Lewis, J. R. (2002). Psychometric evaluation of the PSSUQ using data from five years of usability studies. *International Journal of Human-Computer Interaction*, *14*(3–4), 463–488.

Lewis, J. R. (2014). Usability: Lessons Learned … and Yet to Be Learned. *International Journal of Human-Computer Interaction*, *30*(9), 663–684. https://doi.org/10.1080/10447318.2014.930311

Li, J., Sun, X., Wang, C., Zhang, Z., & Xie, Z. (2020). A Mobile Application Penyikang Applied in Postpartum Pelvic Floor Dysfunction: A Cross-Sectional Study to Analyze the Factors Influencing Postpartum Pelvic Floor Muscle Strength and Women's Participation in Treatment. *BioMed Research International*, *2020*, 1–10. https://doi.org/10.1155/2020/4218371

Li, T., Wang, J., Chen, X., Chen, L., & Cai, W. (2021). Obstetric Nurses' Knowledge, Attitudes, and Professional Support Related to Actual Care Practices About Urinary Incontinence. *Female Pelvic Medicine & Reconstructive Surgery*, *27*(2), e377–e384. https://doi.org/10.1097/SPV.0000000000000941

Liang, C. C., Chao, M., Chang, S. D., & Chiu, S. Y. H. (2021). Pregnancy weight gain may affect perinatal outcomes, quality of life during pregnancy, and child-bearing expenses: an observational cohort study. *Archives of Gynecology and Obstetrics*. https://doi.org/10.1007/s00404-021-05983-2

Liebergall-Wischnitzer, M., Hopsink, T., Shimony-Kanat, S., Idilbi, N., Noble, A., & Kienski Woloski Wruble, A. (2021). Development and evaluation of a new pelvic floor muscle training Patient reported Outcome Measures (PROM) (PFMT-P). *European Journal of Obstetrics and Gynecology and Reproductive Biology*, *264*, 353–357. https://doi.org/10.1016/j.ejogrb.2021.07.050

Lim, H. M., Dunn, A. G., Muhammad Firdaus Ooi, S., Teo, C. H., Abdullah, A., Woo, W. J., & Ng, C. J. (2021). mHealth adoption among primary care physicians in Malaysia and its associated factors: a cross-sectional study. *Family Practice*, *38*(3), 210–217. https://doi.org/10.1093/fampra/cmaa103

Lim, R., Liong, M. L., Lau, Y. K., & Yuen, K. H. (2017). Validity, reliability, and responsiveness of the ICIQ-UI SF and ICIQ-LUTSqol in the Malaysian population. *Neurourology and Urodynamics*. https://doi.org/10.1002/nau.22950

Lim, R., Liong, M. L., Leong, W. S., Lau, Y. K., Khan, N. A. K., & Yuen, K. H. (2018). The Impact of Stress Urinary Incontinence on Individual Components of Quality of Life in Malaysian Women. *Urology*. https://doi.org/10.1016/j.urology.2017.10.019

Liu, J., Tan, S. Q., & Han, H. C. (2019). Knowledge of pelvic floor disorder in pregnancy. *International Urogynecology Journal*, *30*(6), 991–1001. https://doi.org/10.1007/s00192-019-03891-3

Loh, K. P., Ramsdale, E., Culakova, E., Mendler, J. H., Liesveld, J. L., O'Dwyer, K. M., McHugh, C., Gilles, M., Lloyd, T., Goodman, M., Klepin, H. D., Mustian, K. M., Schnall, R., & Mohile, S. G. (2018). Novel mHealth App to Deliver Geriatric Assessment-Driven Interventions for Older Adults With Cancer: Pilot Feasibility and Usability Study. *JMIR Cancer*, *4*(2), e10296. https://doi.org/10.2196/10296

Lwanga, S. K., Lemeshow, S., & Organization, W. H. (1991). *Sample size determination in health studies: a practical manual*.

Ma, Y., Mazumdar, M., & Memtsoudis, S. G. (2012). Beyond repeated-measures analysis of variance: Advanced statistical methods for the analysis of longitudinal data in anesthesia research. *Regional Anesthesia and Pain Medicine*, *37*(1), 99–105. https://doi.org/10.1097/AAP.0b013e31823ebc74

Maeda, N., Urabe, Y., Suzuki, Y., Hirado, D., Morikawa, M., Komiya, M., Mizuta, R., Naito, K., & Shirakawa, T. (2021). Cross-Sectional Study of the Prevalence and Symptoms of Urinary Incontinence among Japanese Older Adults: Associations with Physical Activity, Health-Related Quality of Life, and Well-Being. In *International Journal of Environmental Research and Public Health,* *18*(2). https://doi.org/10.3390/ijerph18020360

Maguire, T., Abdelrahman, A., & Maguire, A. (2021). Pilot study exploring the incidence of lower urinary tract symptoms during pregnancy in a district general hospital in Northern Ireland: a prospective survey. *International Urogynecology Journal*, https://doi.org/10.1007/s00192-021-04718-w

Mallett, V. T., Jezari, A. M., Carrillo, T., Sanchez, S., & Mulla, Z. D. (2018). Barriers to seeking care for urinary incontinence in Mexican American women. *International Urogynecology Journal*, *29*(2), 235–241. https://doi.org/10.1007/s00192-017-3420-6

Marcolino, M. S., Oliveira, J. A. Q., D'Agostino, M., Ribeiro, A. L., Alkmim, M. B. M., & Novillo-Ortiz, D. (2018). The Impact of mHealth Interventions: Systematic Review of Systematic Reviews. *JMIR MHealth and UHealth*, *6*(1), e23. https://doi.org/10.2196/mhealth.8873

Maroyi, R., Mwambali, N., Moureau, M. K., Keyser, L. E., McKinney, J. L., Brown, H. W., & Mukwege, D. M. (2021). Prevalence of urinary incontinence in pregnant and postpartum women in the Democratic Republic of Congo. *International Urogynecology Journal*, *32*(7), 1883–1888. https://doi.org/10.1007/s00192-021-04885-w

Martins, E. S., Pinheiro, A. K. B., Aquino, P. de S., Oriá, M. O. B., Castro, R. C. M. B., Lima, D. J. M., Andrade, K. V., Sousa, C. S. P. de, Holanda, S. M., Silva Martins, E., Bezerra Pinheiro, A. K., Souza Aquino, P. de, Batista Oriá, M. O., Barbosa Castro, R. C. M., Maia Lima, D. J., Andrade, K. V., Pires de Sousa, C. S., & Holanda, S. M. (2016). Urinary Incontinence in Pregnant Women: Integrative Review. *Open Journal of Nursing*, *06*(03), 229–238.https://doi.org/10.4236/ojn.2016.63023

Mason, L., Roe, B., Wong, H., Davies, J., & Bamber, J. (2010). The role of antenatal pelvic floor muscle exercises in prevention of postpartum stress incontinence: A randomised controlled trial. *Journal of Clinical Nursing*. https://doi.org/10.1111/j.1365-2702.2010.03297.x

Matthew-Maich, N., Harris, L., Ploeg, J., Markle-Reid, M., Valaitis, R., Ibrahim, S., Gafni, A., & Isaacs, S. (2016). Designing, implementing, and evaluating mobile health technologies for managing chronic conditions in older adults: A scoping review. *JMIR MHealth and UHealth*, *4*(2), 1–18. https://doi.org/10.2196/mhealth.5127

Matthews, J., Win, K. T., Oinas-Kukkonen, H., & Freeman, M. (2016). Persuasive Technology in Mobile Applications Promoting Physical Activity: a Systematic Review. *Journal of Medical Systems*, *40*(3), 72. https://doi.org/10.1007/s10916-015-0425-x

McClurg, D., Frawley, H., Hay-Smith, J., Dean, S., Chen, S.-Y., Chiarelli, P., Mair, F., & Dumoulin, C. (2015). Scoping review of adherence promotion theories in pelvic floor muscle training - 2011 ics state-of-the-science seminar research paper i of iv. *Neurourology and Urodynamics*, *34*(7), 606–614. https://doi.org/10.1002/nau.22769

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation.* John Wiley & Sons.

Messer, K. L., Hines, S. H., Raghunathan, T. E., Seng, J. S., Diokno, A. C., & Sampselle, C. M. (2007). Self-efficacy as a predictor to PFMT adherence in a prevention of urinary incontinence clinical trial. *Health Education and Behavior*, *34*(6), 942–952.https://doi.org/10.1177/1090198106295399

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Eccles, M. P., Cane, J., & Wood, C. E. (2013). The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of Behavior Change Interventions. *Annals of Behavioral Medicine*, *46*(1), 81–95. https://doi.org/10.1007/s12160-013-9486-6

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Science : IS*, *6*, 42. https://doi.org/10.1186/1748-5908-6-42

Milsom, I., Coyne, K. S., Nicholson, S., Kvasz, M., Chen, C.-I., & Wein, A. J. (2014). Global Prevalence and Economic Burden of Urgency Urinary Incontinence: A Systematic Review. *European Urology*, *65*(1), 79–95. https://doi.org/10.1016/j.eururo.2013.08.031

Milsom, I., & Gyhagen, M. (2021). Overview: Epidemiology and Etiology of Urinary Incontinence and Voiding Dysfunction. In G. A. Santoro, A. P. Wieczorek, & A. H. Sultan (Eds.), *Pelvic Floor Disorders* (pp. 239–248). Springer International Publishing. https://doi.org/10.1007/978-3-030-40862-6_16

Miquelutti, M. A., Cecatti, J. G., & Makuch, M. Y. (2013). Evaluation of a birth preparation program on lumbopelvic pain, urinary incontinence, anxiety and exercise: A randomized controlled trial. *BMC Pregnancy and Childbirth*. https://doi.org/10.1186/1471-2393-13-154

Mishra, A., & Dubey, D. (2013). A comparative study of different software development life cycle models in different scenarios. *International Journal of Advance Research in Computer Science and Management Studies*, *1*(5).

Mohd Yusoff, D., Awang, S., & Kueh, Y. C. (2019). Urinary incontinence among pregnant women attending an antenatal clinic at a tertiary teaching hospital in North-East Malaysia. *Journal of Taibah University Medical Sciences*. https://doi.org/10.1016/j.jtumed.2018.11.009

Moossdorff-Steinhauser, H. F. A., Berghmans, B. C. M., Spaanderman, M. E. A., & Bols, E. M. J. (2021a). Urinary incontinence during pregnancy: prevalence, experience of bother, beliefs, and help-seeking behavior. *International Urogynecology Journal*, *32*(3), 695–701. https://doi.org/10.1007/s00192-020-04566-0

Moossdorff-Steinhauser, H. F. A., Berghmans, B. C. M., Spaanderman, M. E. A., & Bols, E. M. J. (2021b). Prevalence, incidence and bothersomeness of urinary incontinence in pregnancy: a systematic review and meta-analysis. *International Urogynecology Journal*, *32*(7), 1633–1652. https://doi.org/10.1007/s00192-020-04636-3

Moossdorff-Steinhauser, H. F. A., Berghmans, B. C. M., Spaanderman, M. E. A., & Bols, E. M. J. (2021c). Urinary incontinence 6 weeks to 1 year post-partum: prevalence, experience of bother, beliefs, and help-seeking behavior. *International Urogynecology Journal*, *32*(7), 1817–1824. https://doi.org/10.1007/s00192-020-04644-3

Morey, S. A., Barg-Walkow, L. H., & Rogers, W. A. (2017). Managing heart failure on the Go: Usability issues with mHealth apps for older adults. *Proceedings of the Human Factors and Ergonomics Society*, *2017-Octob*, 1–5. https://doi.org/10.1177/1541931213601496

Morgan, G. A., Barrett, K. C., Leech, N. L., & Gloeckner, G. W. (2019). *IBM SPSS for introductory statistics: Use and interpretation*. Routledge.

Mostafaei, H., Sadeghi-Bazargani, H., Hajebrahimi, S., Salehi-Pourmehr, H., Ghojazadeh, M., Onur, R., Al Mousa, R. T., & Oelke, M. (2020). Prevalence of female urinary incontinence in the developing world: A systematic review and meta-analysis—A Report from the Developing World Committee of the International Continence Society and Iranian Research Center for Evidence Based Medicine. *Neurourology and Urodynamics*, *39*(4), 1063–1086. https://doi.org/10.1002/nau.24342

Mustafa, N., Safii, N. S., Jaffar, A., Sani, N. S., Mohamad, M. I., Abd Rahman, A. H., & Sidik, S. M. (2021). Malay version of the mhealth app usability questionnaire (M-MAUQ): Translation, adaptation, and validation study. *JMIR MHealth and UHealth*, *9*(2). https://doi.org/10.2196/24457

Nadal, C., Sas, C., & Doherty, G. (2020). Technology acceptance in mobile health: Scoping review of definitions, models, and measurement. *Journal of Medical Internet Research*, *22*(7), 1–17.https://doi.org/10.2196/17256

National Institute for Health and Care Excellence (NICE). (2021). *Evidence Standards Framework for Digital Health Technologies* (Issue March). Retrieved from: https://www.nice.org.uk/about/what-we-do/our-programmes/evidence-standards-framework-for-digital-health-technologies

Navarro-Brazález, B., Vergara-Pérez, F., Prieto-Gómez, V., Sánchez-Sánchez, B., Yuste-Sánchez, M. J., & Torres-Lacomba, M. (2021). What influences women to adhere to pelvic floor exercises after physiotherapy treatment? A qualitative study for individualized pelvic health care. *Journal of Personalized Medicine*, *11*(12). https://doi.org/10.3390/jpm11121368

Navodani, T., Gartland, D., Brown, S. J., Riggs, E., & Yelland, J. (2019). Common maternal health problems among Australian-born and migrant women: A prospective cohort study. *PLoS ONE*, *14*(2), 1–12. https://doi.org/10.1371/journal.pone.0211685

Newman-Beinart, N. A., Norton, S., Dowling, D., Gavriloff, D., Vari, C., Weinman, J. A., & Godfrey, E. L. (2017). The development and initial psychometric evaluation of a measure assessing adherence to prescribed exercise: the Exercise Adherence Rating Scale (EARS). *Physiotherapy*, *103*(2), 180–185. https://doi.org/10.1016/j.physio.2016.11.001

NICE Guideline CG123. (2019). *Urinary incontinence and pelvic organ prolapse in women: management*. Retrieved from: www.nice.org.uk/guidance/ng123

Nielsen, J. (1994). Usability inspection methods. *Conference Companion on Human Factors in Computing Systems - CHI '94*, 413–414. https://doi.org/10.1145/259963.260531

Nielsen, J., & Molich, R. (1990). Heuristic evaluation of user interfaces. *Conference on Human Factors in Computing Systems - Proceedings*, *April*, 249–256. https://doi.org/10.1145/97243.97281

Nigam, A., Ahmad, A., Gaur, D., Elahi, A. A., & Batra, S. (2017). Prevalence and risk factors for urinary incontinence in pregnant women during late third trimester. *Int J Reprod Contracept Obstet Gynecol*, *5*(7), 2187–2191.

Nunes, A. R., Lee, K., & O'Riordan, T. (2016). The importance of an integrating framework for achieving the Sustainable Development Goals: the example of health and well-being. *BMJ Global Health*, *1*(3), e000068. https://doi.org/10.1136/bmjgh-2016-000068

Nyström, E., Asklund, I., Sjöström, M., Stenlund, H., & Samuelsson, E. (2018). Re: Treatment of stress urinary incontinence with a mobile app: factors associated with success. *International Urogynecology Journal*, *29*(9), 1325–1333. https://doi.org/10.1007/s00192-018-3632-4

O'Cathain, A., Croot, L., Duncan, E., Rousseau, N., Sworn, K., Turner, K. M., Yardley, L., & Hoddinott, P. (2019). Guidance on how to develop complex interventions to improve health and healthcare. *BMJ Open*, *9*(8), 1–9. https://doi.org/10.1136/bmjopen-2019-029954

O'Neill, A. T., Hockey, J., O'Brien, P., Williams, A., Morris, T. P., Khan, T., Hardwick, E., & Yoong, W. (2017). Knowledge of pelvic floor problems: a study of third trimester, primiparous women. *International Urogynecology Journal*, *28*(1), 125–129. https://doi.org/10.1007/s00192-016-3087-4

Oinas-Kukkonen, H., & Harjumaa, M. (2008). *A Systematic Framework for Designing and Evaluating Persuasive Systems BT - Persuasive Technology* (H. Oinas-Kukkonen, P. Hasle, M. Harjumaa, K. Segerståhl, & P. Øhrstrøm (eds.); pp. 164–176). Springer Berlin Heidelberg.

Okunola, T. O., Olubiyi, O. A., Omoya, S., Rosiji, B., & Ajenifuja, K. O. (2018). Prevalence and risk factors for urinary incontinence in pregnancy in Ikere-Ekiti, Nigeria. *Neurourology and Urodynamics*. https://doi.org/10.1002/nau.23726

Olander, E. K., Darwin, Z. J., Atkinson, L., Smith, D. M., & Gardner, B. (2016). Beyond the 'teachable moment' – A conceptual analysis of women's perinatal behaviour change. *Women and Birth*, *29*(3), e67–e71. https://doi.org/10.1016/j.wombi.2015.11.005

Olatunbosun, O. A., & Edouard, L. (2021). *Evidence-Based Antenatal Care BT - Contemporary Obstetrics and Gynecology for Developing Countries* (F. Okonofua, J. A. Balogun, K. Odunsi, & V. N. Chilaka (eds.); pp. 91–101). Springer International Publishing. https://doi.org/10.1007/978-3-030-75385-6_10

Orji, R., & Moffatt, K. (2016). Persuasive technology for health and wellness: State-of-the-art and emerging trends. *Health Informatics Journal*, *24*(1), 66–91. https://doi.org/10.1177/1460458216650979

Osborne, C. L., Juengst, S. B., & Smith, E. E. (2021). Identifying user-centered content, design, and features for mobile health apps to support long-term assessment, behavioral intervention, and transitions of care in neurological rehabilitation: An exploratory study. *British Journal of Occupational Therapy*, *84*(2), 101–110. https://doi.org/10.1177/0308022620954115

Overdijkink, S. B., Velu, A. V., Rosman, A. N., van Beukering, M. D. M., Kok, M., & Steegers-Theunissen, R. P. M. (2018). The Usability and Effectiveness of Mobile Health Technology–Based Lifestyle and Medical Intervention Apps Supporting Health Care During Pregnancy: Systematic Review. *JMIR MHealth and UHealth*, *6*(4), e109. https://doi.org/10.2196/mhealth.8834

Pang, H., Lv, J., Xu, T., Li, Z., Gong, J., Liu, Q., Wang, Y., Wang, J., Xia, Z., Li, Z., Li, L., & Zhu, L. (2022). Incidence and risk factors of female urinary incontinence: a 4-year longitudinal study among 24 985 adult women in China. *BJOG: An International Journal of Obstetrics and Gynaecology*, *129*(4), 580–589. https://doi.org/10.1111/1471-0528.16936

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.

Peischl, B., Ferk, M., & Holzinger, A. (2015). The fine art of user-centered software development. *Software Quality Journal*, *23*(3), 509–536. https://doi.org/10.1007/s11219-014-9239-1

Pelaez, M., Gonzalez-Cerron, S., Montejo, R., & Barakat, R. (2014). Pelvic floor muscle training included in a pregnancy exercise program is effective in primary prevention of urinary incontinence: A randomized controlled trial. *Neurourology and Urodynamics*, *33*(1), 67–71. https://doi.org/10.1002/nau.22381

Perera, J., Kirthinanda, D. S., Wijeratne, S., & Wickramarachchi, T. K. (2014). Descriptive cross sectional study on prevalence, perceptions, predisposing factors and health seeking behaviour of women with stress urinary incontinence. *BMC Women's Health*, *14*(1), 78. https://doi.org/10.1186/1472-6874-14-78

Pintos-Díaz, M. Z., Alonso-Blanco, C., Parás-Bravo, P., Fernández-de-Las-Peñas, C., Paz-Zulueta, M., Fradejas-Sastre, V., & Palacios-Ceña, D. (2019). Living with Urinary Incontinence: Potential Risks of Women's Health? A Qualitative Study on the Perspectives of Female Patients Seeking Care for the First Time in a Specialized Center. *International Journal of Environmental Research and Public Health*, *16*(19), 3781. https://doi.org/10.3390/ijerph16193781

Pires, T. F., Pires, P. M., Costa, R., & Viana, R. (2020). Effects of pelvic floor muscle training in pregnant women. *Porto Biomedical Journal*, *5*(5), e077. https://doi.org/10.1097/j.pbj.0000000000000077

Pires, T., Pires, P., Moreira, H., Gabriel, R., Viana, S., & Viana, R. (2020). Assessment of pelvic floor muscles in sportswomen: Quality of life and related factors. *Physical Therapy in Sport*, *43*, 151–156. https://doi.org/10.1016/j.ptsp.2020.02.015

Poudel, A., Dangal, G., & Shrestha, M. (2021). Urinary incontinence among pregnant women in third trimester of pregnancy in a tertiary care center: A descriptive cross-sectional study. *Journal of the Nepal Medical Association*, *59*(240), 752–756. https://doi.org/10.31729/jnma.6914

Pruitt, J., & Adlin, T. (2010). *The persona lifecycle: keeping people in mind throughout product design*. Elsevier.

Przydacz, M., Skalski, M., Sobanski, J., Chlosta, M., Raczynski, K., Klasa, K., Dudek, D., & Chlosta, P. (2021). Association between Lower Urinary Tract Symptoms and Sleep Quality of Patients with Depression. *Medicina*, *57*(4), 394. https://doi.org/10.3390/medicina57040394

Puteh, S. E. W., Ahmad, S. N. A., Aizuddin, A. N., Zainal, R., & Ismail, R. (2017). Patients' willingness to pay for their drugs in primary care clinics in an urbanized setting in Malaysia: a guide on drug charges implementation. *Asia Pacific Family Medicine*, *16*(1), 1–8. https://doi.org/10.1186/s12930-017-0035-5

Quek, D. (2009, April). The Malaysian healthcare system: a review. In *Intensive workshop on health systems in transition* (pp. 29-30). Retrieved from: https://www.researchgate.net/publication/237409933

Reilly, E. T. C., Freeman, R. M., Waterfield, M. R., Waterfield, A. E., Steggles, P., & Pedlar, F. (2002). Prevention of postpartum stress incontinence in primigravidae with increased bladder neck mobility: a randomised controlled trial of antenatal pelvic floor exercises. *BJOG: An International Journal of Obstetrics & Gynaecology*, *109*(1), 68–76. https://doi.org/10.1111/j.1471-0528.2002.t01-1-01116.x

Ren, S., Gao, Y., Yang, Z., Li, J., Xuan, R., Liu, J., Chen, X., & Thirupathi, A. (2020). The effect of pelvic floor muscle training on pelvic floor dysfunction in pregnant and postpartum women. *Physical Activity and Health*, *4*(1). https://doi.org/10.5334/paah.64

Robinson, K. A., Dinglas, V. D., Sukrithan, V., Yalamanchilli, R., Mendez-Tellez, P. A., Dennison-Himmelfarb, C., & Needham, D. M. (2015). Updated systematic review identifies substantial number of retention strategies: Using more strategies retains more study participants. *Journal of Clinical Epidemiology*, *68*(12), 1481–1487. https://doi.org/10.1016/j.jclinepi.2015.04.013

Rosediani, M., Juliawati, M., & Norwati, D. (2012). Knowledge, attitude and practice towards pelvic floor muscle exercise among pregnant women attending antenatal clinic in Universiti Sains Malaysia Hospital, Malaysia. *International Medical Journal*, *19*(1), 37–38.

Rygh, P, Asklund, I., & Samuelsson, E. (2021). Real-world effectiveness of app-based treatment for urinary incontinence: A cohort study. *BMJ Open*, *11*(1). https://doi.org/10.1136/bmjopen-2020-040819

Sacomori, C., Berghmans, B., de Bie, R., Mesters, I., & Cardoso, F. L. (2018). Predictors for adherence to a home-based pelvic floor muscle exercise program for treating female urinary incontinence in Brazil. *Physiotherapy Theory and Practice*. https://doi.org/10.1080/09593985.2018.1482583

Sacomori, C., Berghmans, B., Mesters, I., de Bie, R., & Cardoso, F. L. (2015). Strategies to enhance self-efficacy and adherence to home-based pelvic floor muscle exercises did not improve adherence in women with urinary incontinence: a randomised trial. *Journal of Physiotherapy*, *61*(4), 190–198. https://doi.org/10.1016/j.jphys.2015.08.005

Sacomori, C., Cardoso, F. L., Porto, I. P., & Negri, N. B. (2013). The development and psychometric evaluation of a self-efficacy scale for practicing pelvic floor exercises. *Brazilian Journal of Physical Therapy*. https://doi.org/10.1590/S1413-35552012005000104

Sacomori, C., Zomkowski, K., dos Passos Porto, I., Cardoso, F. L., & Sperandio, F. F. (2020). Adherence and effectiveness of a single instruction of pelvic floor exercises: a randomized clinical trial. *International Urogynecology Journal*, *31*(5), 951–959. https://doi.org/10.1007/s00192-019-04032-6

Salmon, V. E., Hay-Smith, E. J. C., Jarvie, R., Dean, S., Oborn, E., Bayliss, S. E., Bick, D., Davenport, C., Ismail, K. M., MacArthur, C., & Pearson, M. (2017). Opportunities, challenges and concerns for the implementation and uptake of pelvic floor muscle assessment and exercises during the childbearing years: Protocol for a critical interpretive synthesis. *Systematic Reviews*, *6*(1), 1–9. https://doi.org/10.1186/s13643-017-0420-z

Salmon, V. E., Hay-Smith, E. J. C., Jarvie, R., Dean, S., Terry, R., Frawley, H., Oborn, E., Bayliss, S. E., Bick, D., Davenport, C., MacArthur, C., & Pearson, M. (2020). Implementing pelvic floor muscle training in women's childbearing years: A critical interpretive synthesis of individual, professional, and service issues. *Neurourology and Urodynamics*, *39*(2), 863–870. https://doi.org/10.1002/nau.24256

Sangsawang, B. (2014). Risk factors for the development of stress urinary incontinence during pregnancy in primigravidae: A review of the literature. In *European Journal of Obstetrics Gynecology and Reproductive Biology*. https://doi.org/10.1016/j.ejogrb.2014.04.010

Sangsawang, B., & Sangsawang, N. (2013). Stress urinary incontinence in pregnant women: a review of prevalence, pathophysiology, and treatment. *International Urogynecology Journal*, *24*(6), 901–912. https://doi.org/10.1007/s00192-013-2061-7

Sangsawang, B., & Sangsawang, N. (2016). Is a 6-week supervised pelvic floor muscle exercise program effective in preventing stress urinary incontinence in late pregnancy in primigravid women?: a randomized controlled trial. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, *197*, 103–110. https://doi.org/10.1016/j.ejogrb.2015.11.039

Sangsawang, B., & Serisathien, Y. (2012). Effect of pelvic floor muscle exercise programme on stress urinary incontinence among pregnant women. *Journal of Advanced Nursing*, *68*(9), 1997–2007. https://doi.org/10.1111/j.1365-2648.2011.05890.x

Saparamadu, A. A. D. N. S., Fernando, P., Zeng, P., Teo, H., Goh, A., Lee, J. M. Y., & Lam, C. W. L. (2021). User-Centered Design Process of an mHealth App for Health Professionals: Case Study. *JMIR MHealth and UHealth*, *9*(3), e18079. https://doi.org/10.2196/18079

Sawaqed, F., Al Kharabsheh, A., Tout, M., Zaidan, M., Khashram, H., & AlShunaigat, N. (2020). Prevalence of stress urinary incontinence and its impact on quality of life among women in Jordan: a correlational study. *Journal of International Medical Research*, *48*(5), 030006052092565. https://doi.org/10.1177/0300060520925651

Sayner, A. M., Tang, C. Y., Toohey, K., Mendoza, C., & Nahon, I. (2022). Opportunities and Capabilities to Perform Pelvic Floor Muscle Training Are Critical for Participation: a Systematic Review and Qualitative Meta-Synthesis. *Physical Therapy*, pzac106. https://doi.org/10.1093/ptj/pzac106

Schnall, R., Rojas, M., Bakken, S., Brown, W., Carballo-Dieguez, A., Carry, M., Gelaude, D., Mosley, J. P., & Travers, J. (2016). A user-centered model for designing consumer mobile health (mHealth) applications (apps). *Journal of Biomedical Informatics*, *60*, 243–251. https://doi.org/10.1016/j.jbi.2016.02.002

Selangor State Health Department. (2015). *Yearly Report 2015*. Retrieved from: http://www.jknselangor.moh.gov.my/

Selangor State Health Department. (2019). *Health Facts 2019*. Retrieved from: jknselangor.moh.gov.my/images/2020/info/HealthFacts20182019.pdf

Sen, S., Patel, M., & Sharma, A. K. (2021). *Software Development Life Cycle Performance Analysis* (R. Mathur, C. P. Gupta, V. Katewa, D. S. Jat, & N. Yadav (eds.); pp. 311–319). Springer Singapore. https://doi.org/10.1007/978-981-16-3915-9_27

Shareef, S., & Khan, M. N. A. (2019). Evaluation of Usability Dimensions of Smartphone Applications. *International Journal of Advanced Computer Science and Applications*, *10*(9), 426–431. https://doi.org/10.14569/IJACSA.2019.0100956

Shijagurumayum Acharya, R., Tveter, A. T., Grotle, M., Khadgi, B., Braekken, I. H., & Stuge, B. (2020). Pelvic floor muscle training programme in pregnant Nepalese women—a feasibility study. *International Urogynecology Journal*, *31*(8), 1609–1619. https://doi.org/10.1007/s00192-019-04053-1

Shoemaker, S. J., Wolf, M. S., & Brach, C. (2014). Development of the Patient Education Materials Assessment Tool (PEMAT): A new measure of understandability and actionability for print and audiovisual patient information. *Patient Education and Counseling*, *96*(3), 395–403. https://doi.org/10.1016/j.pec.2014.05.027

Shrestha, B., & Dunn, L. (2020). The Declaration of Helsinki on Medical Research involving Human Subjects: A Review of Seventh Revision. *Journal of Nepal Health Research Council*, *17*(4), 548–552. https://doi.org/10.33314/jnhrc.v17i4.1042

Siahkal, S. F., Iravani, M., Mohaghegh, Z., Sharifipour, F., & Zahedian, M. (2020). Maternal, obstetrical and neonatal risk factors' impact on female urinary incontinence: a systematic review. *International Urogynecology Journal*, *31*(11), 2205–2224. https://doi.org/10.1007/s00192-020-04442-x

Sidik, S. M., Jaffar, A., Foo, C. N., Muhammad, N. A., Abdul Manaf, R., Ismail, S. I. F., Alagirisamy, P., Ahmad Fazlah, A. F., Suli, Z., & Goodyear-Smith, F. (2021). KEPT-app trial: a pragmatic, single-blind, parallel, cluster-randomised effectiveness study of pelvic floor muscle training among incontinent pregnant women: study protocol. *BMJ Open*, *11*(1), e039076. https://doi.org/10.1136/bmjopen-2020-039076

Silva Martins, E., Bezerra Pinheiro, A. K., Souza Aquino, P. de, Batista Oriá, M. O., Barbosa Castro, R. C. M., Maia Lima, D. J., Andrade, K. V., Pires de Sousa, C. S., & Holanda, S. M. (2016). Urinary Incontinence in Pregnant Women: Integrative Review. *Open Journal of Nursing*, *06*(03), 229–238. https://doi.org/10.4236/ojn.2016.63023

Siracusano, S., Pregazzi, R., D'Aloia, G., Sartore, A., Di Benedetto, P., Pecorari, V., Guaschino, S., Pappagallo, G., & Belgrano, E. (2003). Prevalence of urinary incontinence in young and middle-aged women in an Italian urban area. *European Journal of Obstetrics Gynecology and Reproductive Biology*. https://doi.org/10.1016/S0301-2115(02)00407-4

Skelly, J., Rush, J., Eyles, P., Burlock, S., Morrow, C., & Fedorkow, D. (2004). Postpartum urinary incontinence: regional prevalence and the impact of teaching pelvic muscle exercises to pregnant women with UI. *Proceedings of the Joint Meeting of the International Continence Society (ICS)(34th Annual Meeting) and the International UroGynecological Association (IUGA)*, 23–27.

Slade, S. C., Morris, M. E., Frawley, H., & Hay-Smith, J. (2021). Comprehensive reporting of pelvic floor muscle training for urinary incontinence: CERT-PFMT. *Physiotherapy*, *112*, 103–112. https://doi.org/10.1016/j.physio.2021.03.001

Soave, I., Scarani, S., Mallozzi, M., Nobili, F., Marci, R., & Caserta, D. (2019). Pelvic floor muscle training for prevention and treatment of urinary incontinence during pregnancy and after childbirth and its effect on urinary system and supportive structures assessed by objective measurement techniques. *Archives of Gynecology and Obstetrics*, *299*(3), 609–623. https://doi.org/10.1007/s00404-018-5036-6

Sobhgol, S. S., Smith, C. A., & Dahlen, H. G. (2020). The effect of antenatal pelvic floor muscle exercises on labour and birth outcomes: a systematic review and meta-analysis. *International Urogynecology Journal*, *31*(11), 2189–2203. https://doi.org/10.1007/s00192-020-04298-1

Soltani, H., Furness, P. J., Arden, M. A., McSeveny, K., Garland, C., Sustar, H., & Dearden, A. (2012). Women's and midwives' perspectives on the design of a text messaging support for maternal obesity services: An exploratory study. *Journal of Obesity*, *2012*. https://doi.org/10.1155/2012/835464

Sousa, V. D., & Rojjanasrirat, W. (2011). Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline. *Journal of Evaluation in Clinical Practice*, *17*(2), 268–274. https://doi.org/10.1111/j.1365-2753.2010.01434.x

Sporrel, K., Nibbeling, N., Wang, S., Ettema, D., & Simons, M. (2021). Unraveling mobile health exercise interventions for adults: Scoping review on the implementations and designs of persuasive strategies. *JMIR MHealth and UHealth*, *9*(1). https://doi.org/10.2196/16282

Stafne, S. N., Salvesen, K. Å., Romundstad, P. R., Torjusen, I. H., & Mørkved, S. (2012). Does regular exercise including pelvic floor muscle training prevent urinary and anal incontinence during pregnancy? A randomised controlled trial. *BJOG: An International Journal of Obstetrics and Gynaecology*. https://doi.org/10.1111/j.1471-0528.2012.03426.x

Stensdotter, A.-K., Håland, A., Ytterhus, B., Shrestha, S., & Stuge, B. (2021). Pregnant women's experiences with a pelvic floor muscle training program in Nepal. *Global Health Action*, *14*(1). https://doi.org/10.1080/16549716.2021.1940762

Stothers, L. (2002). A randomzed controlled trial to evaluate intrapartum pelvic floor exercise as a method of preventing urinary incontinence. *Journal of Urology*, *167*(4), 106.

Strecher, V. J., Becker, M. H., & Rosenstock, I. M. (1988). Social Learning Theory and the Health Belief Model. *Health Education Quarterly*, *15*(2), 175–183.

Subak, L. L., Brown, J. S., Kraus, S. R., Brubaker, L., Lin, F., Richter, H. E., Bradley, C. S., & Grady, D. (2006). The "costs" of urinary incontinence for women. *Obstetrics and Gynecology*, *107*(4), 908–916. https://doi.org/10.1097/01.AOG.0000206213.48334.09

Subak, L., Van Den Eeden, S., Thom, D., Creasman, J. M., Brown, J. S., & Group, R. R. for I. S. at K. (RRISK) R. (2007). Urinary incontinence in women: direct costs of routine care. *American Journal of Obstetrics and Gynecology*, *197*(6), 596-e1.

Tanahashi, T. (1978). Health service coverage and its evaluation. *Bulletin of the World Health Organization*, *56*(2), 295–303.

Temtanakitpaisan, T., Bunyavejchevin, S., Buppasiri, P., & Chongsomchai, C. (2020). Knowledge, Attitude, and Practices (KAP) Survey Towards Pelvic Floor Muscle Training (PFMT) Among Pregnant Women. *International Journal of Women's Health*, *12*, 295–299. https://doi.org/10.2147/IJWH.S242432

Terry, R., Jarvie, R., Hay-Smith, J., Salmon, V., Pearson, M., Boddy, K., MacArthur, C., & Dean, S. (2020). "Are you doing your pelvic floor?" An ethnographic exploration of the interaction between women and midwives about pelvic floor muscle exercises (PFME) during pregnancy. *Midwifery*, *83*, 102647.https://doi.org/10.1016/j.midw.2020.102647

Thabane, L., Hopewell, S., Lancaster, G. A., Bond, C. M., Coleman, C. L., Campbell, M. J., & Eldridge, S. M. (2016). Methods and processes for development of a CONSORT extension for reporting pilot randomized controlled trials. *Pilot and Feasibility Studies*, *2*(1), 25. https://doi.org/10.1186/s40814-016-0065-z

Thurmond, V. A. (2001). The point of triangulation. *Journal of Nursing Scholarship*, *33*(3), 253–258.

Ting, H. Y., & Cesar, J. A. (2020). Urinary incontinence among pregnant women in Southern Brazil: A population-based cross-sectional survey. *PloS One*, *15*(6), e0234338–e0234338. https://doi.org/10.1371/journal.pone.0234338

Tunçalp, Pena-Rosas, J. P., Lawrie, T., Bucagu, M., Oladapo, O. T., Portela, A., & Metin Gülmezoglu, A. (2017). WHO recommendations on antenatal care for a positive pregnancy experience—going beyond survival. *BJOG: An International Journal of Obstetrics and Gynaecology*, *124*(6), 860–862. https://doi.org/10.1111/1471-0528.14599

Van Geelen, H., Ostergard, D., & Sand, P. (2018). A review of the impact of pregnancy and childbirth on pelvic floor function as assessed by objective measurement techniques. *International Urogynecology Journal*, *29*(3), 327–338. https://doi.org/10.1007/s00192-017-3540-z

van Haasteren, A., Gille, F., Fadda, M., & Vayena, E. (2019). Development of the mHealth App Trustworthiness checklist. *Digital Health*, *5*, 1–21. https://doi.org/10.1177/2055207619886463

Vaz, C. T., Sampaio, R. F., Saltiel, F., & Figueiredo, E. M. (2019). Effectiveness of pelvic floor muscle training and bladder training for women with urinary incontinence in primary care: a pragmatic controlled trial. *Brazilian Journal of Physical Therapy*, *23*(2), 116–124. https://doi.org/10.1016/j.bjpt.2019.01.007

Vickery, M., van Teijlingen, E., Hundley, V., Smith, G., Way, S., & Westwood, G. (2020). Midwives' views towards women using mHealth and eHealth to self-monitor their pregnancy: A systematic review of the literature. *European Journal of Midwifery*, *4*(September), 1–11. https://doi.org/10.18332/ejm/126625

Voth, E. C., Oelke, N. D., & Jung, M. E. (2016). A theory-based exercise app to enhance exercise adherence: A pilot study. *JMIR MHealth and UHealth*, *4*(2), 1–12. https://doi.org/10.2196/mhealth.4997

Wadensten, T., Nyström, E., Franzén, K., Lindam, A., Wasteson, E., & Samuelsson, E. (2021). A mobile app for self-management of urgency and mixed urinary incontinence in women: Randomized controlled trial. *Journal of Medical Internet Research*, *23*(4), 1–16. https://doi.org/10.2196/19439

Wagg, A. R., Kendall, S., & Bunn, F. (2017). Women's experiences, beliefs and knowledge of urinary symptoms in the postpartum period and the perceptions of health professionals: A grounded theory study. *Primary Health Care Research and Development*, *18*(5), 448–462. https://doi.org/10.1017/S1463423617000366

Wang, K., Xu, X., Jia, G., & Jiang, H. (2020). Risk Factors for Postpartum Stress Urinary Incontinence: a Systematic Review and Meta-analysis. *Reproductive Sciences*, *27*(12), 2129–2145. https://doi.org/10.1007/s43032-020-00254-y

Wang, M. (2014). Generalized Estimating Equations in Longitudinal Data Analysis: A Review and Recent Developments. *Advances in Statistics*, *2014*, 1–11. https://doi.org/10.1155/2014/303728

Wang, X., Jin, Y., Xu, P., & Feng, S. (2022). Urinary incontinence in pregnant women and its impact on health-related quality of life. *Health and Quality of Life Outcomes*, *20*(1), 1–8.https://doi.org/10.1186/s12955-022-01920-2

Wang, X., Xu, X., Luo, J., Chen, Z., & Feng, S. (2020). Effect of app-based audio guidance pelvic floor muscle training on treatment of stress urinary incontinence in primiparas: A randomized controlled trial. *International Journal of Nursing Studies*, *104*, 103527. https://doi.org/10.1016/j.ijnurstu.2020.103527

Whitehead, A. L., Julious, S. A., Cooper, C. L., & Campbell, M. J. (2016). Estimating the sample size for a pilot randomised trial to minimise the overall trial sample size for the external pilot and main trial for a continuous outcome variable. *Statistical Methods in Medical Research*, *25*(3), 1057–1073. https://doi.org/10.1177/0962280215588241

Whitford, H. M., & Jones, M. (2011). An exploration of the motivation of pregnant women to perform pelvic floor exercises using the revised theory of planned behaviour. *British Journal of Health Psychology*. https://doi.org/10.1111/j.2044-8287.2010.02013.x

Whittaker, R., Merry, S., Dorey, E., & Maddison, R. (2012). A Development and Evaluation Process for mHealth Interventions: Examples From New Zealand. *Journal of Health Communication*, *17*(sup1), 11–21. https://doi.org/10.1080/10810730.2011.649103

Wilson, P. D., & Herbison, G. P. (1998). A randomized controlled trial of pelvic floor muscle exercises to treat postnatal urinary incontinence. *International Urogynecology Journal*, *9*(5), 257–264.

Witteman, H. O., Vaisson, G., Provencher, T., Chipenda Dansokho, S., Colquhoun, H., Dugas, M., Fagerlin, A., Giguere, A. M., Haslett, L., Hoffman, A., Ivers, N. M., Légaré, F., Trottier, M.-E., Stacey, D., Volk, R. J., & Renaud, J.-S. (2021). An 11-Item Measure of User- and Human-Centered Design for Personal Health Tools (UCD-11): Development and Validation. *Journal of Medical Internet Research*, *23*(3), e15032. https://doi.org/10.2196/15032

Woldringh, C., van den Wijngaart, M., Albers-Heitner, P., Lycklama à Nijeholt, A. A. B., & Lagro-Janssen, T. (2007). Pelvic floor muscle training is not effective in women with UI in pregnancy: a randomised controlled trial. *International Urogynecology Journal*, *18*(4), 383–390. https://doi.org/10.1007/s00192-006-0175-x

Wong, S. T., Saddki, N., & Arifin, W. N. (2019). Validity of the Bahasa Malaysia Version of Patient Education Materials Assessment Tool. *Malaysian Journal of Public Health Medicine*, *19*, 35.

Woodley, S. J., & Hay-Smith, E. J. C. (2021). Narrative review of pelvic floor muscle training for childbearing women—why, when, what, and how. *International Urogynecology Journal*, *32*(7), 1977–1988. https://doi.org/10.1007/s00192-021-04804-z

Woodley, S. J., Lawrenson, P., Boyle, R., Cody, J. D., Mørkved, S., Kernohan, A., & Hay-Smith, E. J. C. (2020). Pelvic floor muscle training for preventing and treating urinary and faecal incontinence in antenatal and postnatal women. *Cochrane Database of Systematic Reviews*, *2020*(5), CD007471. https://doi.org/10.1002/14651858.CD007471.pub4

Wuytack, F., Moran, P., Daly, D., & Begley, C. (2022). Is there an association between parity and urinary incontinence in women during pregnancy and the first year postpartum?: A systematic review and meta-analysis. *Neurourology and Urodynamics*, *41*(1), 54–90. https://doi.org/10.1002/nau.24785

Yan, L. L., Gong, E., Gu, W., Turner, E. L., Gallis, J. A., Zhou, Y., Li, Z., McCormack, K. E., Xu, L.-Q., Bettger, J. P., Tang, S., Wang, Y., & Oldenburg, B. (2021). Effectiveness of a primary care-based integrated mobile health intervention for stroke management in rural China (SINEMA): A cluster-randomized controlled trial. *PLOS Medicine*, *18*(4), e1003582. https://doi.org/10.1371/journal.pmed.1003582

Yeoh, P. L., Hornetz, K., & Dahlui, M. (2016). Antenatal Care Utilisation and Content between Low-Risk and High-Risk Pregnant Women. *PLOS ONE*, *11*(3), e0152167. https://doi.org/10.1371/journal.pone.0152167

Yin, R. K. (2013). Validity and generalization in future case study evaluations. *Evaluation*, *19*(3), 321–332. https://doi.org/10.1177/1356389013497081

Yin, R. K. (2018). *Case study research and applications* (Sixth ed). Sage publications.

Yount, S. M., Fay, R. A., & Kissler, K. J. (2021). Prenatal and Postpartum Experience, Knowledge and Engagement with Kegels: A Longitudinal, Prospective, Multisite Study. *Journal of Women's Health*, *30*(6), 891–901. https://doi.org/10.1089/jwh.2019.8185

Zhou, L., Bao, J., Setiawan, I. M. A., Saptono, A., & Parmanto, B. (2019). The mHealth App Usability Questionnaire (MAUQ): Development and Validation Study. *JMIR MHealth and UHealth*, *7*(4), e11500. https://doi.org/10.2196/11500

Zubieta, M., Carr, R. L., Drake, M. J., & Bø, K. (2016). Influence of voluntary pelvic floor muscle contraction and pelvic floor muscle training on urethral closure pressures: a systematic literature review. *International Urogynecology Journal*, *27*(5), 687–696. https://doi.org/10.1007/s00192-015-2856-9