A User Centred Mobile Health Approach to Postnatal Depression Intervention Adherence Management using the Theory of Planned Behaviour

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The thesis is submitted in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy of the University of Portsmouth.
Abstract

This research contributes to the development of an intervention that could facilitate adherence to prescribed Postnatal Depression (PND) interventions, and that is achieved by behavioural change. Non-adherence to prescribed PND treatment is a major problem faced by healthcare professionals. Primarily the negative impact upon women’s wellbeing is of significant concern. Secondly, there can be an increase in the cost of providing healthcare service, both in financial terms and time investment. A lack of adherence to treatment is prevalent in women with PND and has shown to decrease the long-term effect of the treatment outcome as well as increase the length of time spent in treatment for psychological disorders. Furthermore, we identified that a large number of women poorly adhere to the prescribed treatment or show only moderate improvement in depression. To help improve increased adherence to PND treatments, however, this would require a change in behaviour.

In order to rigoursly approach this research, this thesis capitalises on a behavioural change model ‘The Theory of Planned Behaviour (TPB)’. A User Centred Design (UCD) and mixed method studies were used in the first stage of this research to identify the perception of women and practitioners on factors that could have an impact on PND treatment adherence. The results of these studies provided valuable insights that lead to the significant development of the ABC-W. TPB guided the development of a novel Adherence Behavioural Change Wheel (ABC-W) for PND. Significantly, the ABC-W has the potential to identify and address women’s behavioural, control beliefs and the perception of significant others that could influence treatment adherence behavioural for PND. It could further help to bridge the gap between the intention to adhere to treatment and carrying out the actual behaviour. It is, however, not anticipated that the proposed adherence framework will replace other measures, but aims to complement existing compliance strategies. This is because we are not practitioners and make no claims that the outcome of this research will cure PND. However, using the increasing mobile technology, we seek to contribute to the development of interventions that could facilitate adherence to prescribed treatments, ensure sustained treatment outcome and most importantly positively impact upon the wellbeing and lives of women with PND.

Advances in mobile technology have enabled a wide range of behavioural change interventions. We identified that using mobile technology for PND treatment support could promote prescribed treatment adherence and long-term maintenance of behavioural change. Therefore, a scenario was developed from the ABC-W and subsequently translated into a set of high-level requirements, which will significantly inform the development of a PND adherence
mobile application. This set of requirements contributes to the rapid expanding field of mobile health for women with PND. Detailed description and rationale for the set of general requirements were presented using Volere shell, a requirement specification tool. These requirements were used to shape the development of an adjunct mobile application prototype, AbovePostnatalDepression. AbovePostnatalDepression is the first PND adherence mobile application that has the potential to facilitate adherence to prescribed PND treatments. Furthermore, using the elements of TPB, practitioners evaluated the potential of AbovePostnatalDepression against the features of the ABC-W framework. This study is the first evaluation of an adherence mobile application for women with PND. This research identified whether the AbovePostnatalDepression as an adherence tool could help women with PND have control over their adherence behaviour as well as help facilitate sustained treatment outcome. We identified that AbovePostnatalDepression could be used to motivate postnatal depressed women to adhere to treatment and sustain treatment outcome in the long-term. By using the AbovePostnatalDepression there is a possibility of reducing procedural cost, time or efforts required by practitioner and women alike in ensuring increased adherence to prescribed treatments, but of paramount importance is the potential positive impact it could have on women’s wellbeing.
Declaration

Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.

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Omobolanle Omisade
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<td>BDI</td>
<td>Beck Depression Inventory</td>
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<tr>
<td>CBT</td>
<td>Cognitive Behavioural Therapy</td>
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<tr>
<td>CCBT</td>
<td>Computerized Cognitive Behavioural Therapy</td>
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<tr>
<td>CSS</td>
<td>Cross-Sectional Survey</td>
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<tr>
<td>ECN</td>
<td>Early Childhood Nurse</td>
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<tr>
<td>EPDS</td>
<td>Edinburgh Postnatal Depression Scale</td>
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<tr>
<td>FF</td>
<td>Face to Face</td>
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<tr>
<td>HP</td>
<td>Therapist, Psychiatrist, GP, Clinicians</td>
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<td>HRSD</td>
<td>Hamilton Rating Scale for Depression</td>
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<tr>
<td>HV</td>
<td>Health Visitor</td>
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<td>HVHW</td>
<td>Home visits from healthcare workers</td>
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<td>IPA</td>
<td>Interpretative Phenomenological Analysis</td>
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<td>IPT</td>
<td>Interpersonal Therapy</td>
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<tr>
<td>MADRS</td>
<td>Montgomery-Asberg Depression Rating Scale</td>
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<tr>
<td>NICE</td>
<td>National Institute for Health and Care Excellence</td>
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<tr>
<td>NR</td>
<td>Not reported</td>
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<tr>
<td>OSHP</td>
<td>Online self-help program</td>
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<td>PCA</td>
<td>Person Centred Approach</td>
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<tr>
<td>PCC</td>
<td>Primary Care Centre</td>
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<tr>
<td>PCN</td>
<td>Primary Care / Early Childhood Nurse</td>
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<td>PDSS</td>
<td>Postpartum Depression Screening Scale</td>
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<tr>
<td>PH</td>
<td>Participant’s home</td>
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<tr>
<td>PHI</td>
<td>Psychological Intervention</td>
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<td>PMI</td>
<td>Pharmacological intervention</td>
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<tr>
<td>PND</td>
<td>Postnatal Depression</td>
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<tr>
<td>PST</td>
<td>Problem Solving Therapy</td>
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<td>PP</td>
<td>Puerperal Psychosis</td>
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<tr>
<td>PT</td>
<td>Participant telephone / mobile phone</td>
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<tr>
<td>RC</td>
<td>Researcher</td>
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<tr>
<td>RCT</td>
<td>Randomised Control Trial</td>
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<tr>
<td>SH</td>
<td>Self-Help</td>
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<tr>
<td>SSI</td>
<td>Semi-Structured Interview</td>
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<td>SSP</td>
<td>Structured sessions with peers</td>
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<tr>
<td>ST</td>
<td>Help from sessions with a therapist</td>
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<tr>
<td>SUS</td>
<td>System Usability Scale</td>
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<tr>
<td>TPB</td>
<td>Theory of Planned Behaviour</td>
</tr>
<tr>
<td>UC</td>
<td>Usual care</td>
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<tr>
<td>WBT</td>
<td>Well-being Therapy</td>
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WLC  Waiting-list control
Dissemination

Publications


Posters

Mobile Health: User Centred Development to support women with Postnatal Depression. Poster Presentation at the SIHI Conference 2014: Informatics to deliver integrated care

User Centred Development of a therapeutic / diagnostic support model for the wellbeing of women with Postnatal Depression. Poster presentation at the University of Portsmouth research conference, 2015

User Centred Development of a therapeutic / diagnostic support model for the wellbeing of women with Postnatal Depression. Poster presentation at the Annual Faculty of Technology Research Conference 2016


Theory-based development of a mobile health model to support the wellbeing and intervention adherence of women with Postnatal Depression (2017). 1st Annual UK Maternal Mental Health Alliance Conference. London. UK

Presentations

Acceptance of mobile health: User Centred Methodology to support women with Postnatal
Depression. Poster presentation at the University of Portsmouth, Faculty of Technology Research Conference, 2014.

A Mobile Health Model to Support the Wellbeing and Intervention Adherence of Women with Postnatal Depression. Pot Pourri of Computing Research at the BCS Hampshire Branch and School of Computing, University of Portsmouth, 2018
Acknowledgement and dedication

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I dedicate my PhD to my late dad, Dr Kolawole Oyeyiola Adeyeye and late mother-in-law, Mrs Titilayo Christiana Omisade. May your souls rest in peace.
1. Introduction

1.1. Postnatal Depression

Postnatal depression (PND) is a devastating but treatable mood disorder that can make people lonely, distressed and frightened, leaving mothers and their families in peril. Previous studies report that 13% of women having babies suffer from PND (Glover, Onozawa, & Hodgkinson, 2002; O’Mahen et al., 2014). This equates to about 70,000 women experiencing PND in the United Kingdom every year (Dennis & Stewart, 2004; Evans, Donelle, & Hume-Loveland, 2012; Morrell, 2006). As will be discussed in much detail in chapter two of this thesis, women are vulnerable to the affective mood disorder PND, which can occur in the first three months after childbirth (Beck, 2002; O’Mahen et al., 2014). PND represents the most frequent form of maternal morbidity following delivery (Cuijper, Brannmark, & Van Straten, 2008; Gibson, McKenzie-McHarg, Shakespeare, Price, Gray, 2009). Like other episodes of depression, PND affects a postnatal woman’s feeling about herself and her interpersonal relationships; and she may be functioning only minimally in her role as a mother (Beck, 2002a). Additionally, PND can have serious consequences for the infant, which can include lower progression weight; impaired mental and emotional development; difficult temperament; poor self-regulation; low self-esteem; sudden infant death syndrome; or an overall higher frequency of hospital admissions and long-term behavioural problems (Glover et al., 2002; Grace, Evindar, & Stewart, 2003; Morrell, 2006; Nielsen, Videbech, Hedegaard, Dalby, & Secher, 2000; O’Mahen et al., 2012b).

Antidepressant medication is usually the first treatment offered to treat the symptoms of PND. There is evidence to support its efficacy when used as prescribed, but it is often associated with side effects such as decrease in appetite, nausea (Hou et al., 2014; Yonkers et al, 2008). The high attrition rate in PND interventions remains a significant problem that needs to be solved. One possible reason for high attrition for the use of antidepressants might be related to the fact that postnatal depressed mothers consistently indicate that they prefer therapy to antidepressants because of the concern over safety when breastfeeding (Hou et al., 2014). Alternatively, psychotherapy is an effective treatment and support for PND. Milgrom et al. (2006) suggested that counselling informed by the principles of Cognitive Behavioural Therapy (CBT) (a form of psychotherapy) is effective when delivered by maternal and child health nurses. Interpersonal Therapy (IPT) has also been found to be effective for this population (Klier, Muzik, Rosenblum, & Lenz, 2001). However, the postnatal period still presents specific
barriers to adequate improvement in depression, and a large number of women remain without treatment, do not adhere to the prescribed intervention or show only moderate improvement in depression (Boath et al., 2004; O'Mahen et al., 2015b).

More recently, computerised self-help approaches using the Internet have been developed to provide greater access and flexibility of receiving psychotherapy while requiring minimal input from a therapist (O'Mahen et al., 2014). The National Institute for Health and Care Excellence (NICE) has recommended the use of Computerized Cognitive Behavioural Therapy (CCBT) software for depression (NICE, 2006). CCBT has shown to be effective for PND, with less time required in usual care and shorter therapist time needed while providing engagement and quality support (Gerhards et al., 2010; Kaltenthaler, Parry, Beverley, & Ferriter, 2008b; Merry et al., 2012). These effective treatments will be discussed further in section 2.3 while adherence to treatment is described in chapter three of this thesis.

Research suggests that, despite effective treatment options, a large number of depressed women comply poorly with treatment or show only moderate improvement in depression (McCarthy & McMahon, 2008). In some cases, depressed women with other young children attributed poor intervention adherence to the struggles and cost associated with transportation or other overwhelming responsibilities that can interfere with the ability to attend scheduled appointments (de Graaf, Huibers, Riper, Gerhards, & Arntz, 2009; Kaltenthaler, Parry, Beverley, & Ferriter, 2008a; McCarthy & McMahon, 2008; Merry et al., 2012; Wan, Hu, Moore, & Ashford, 2008). Adherence is defined as the extent to which a person’s behaviour conforms to medical or health advice (Bruer, 1982, Pampallona, Bollini, Tibaldi, Kupelnick, & Munizza, 2002). This will be discussed in much more detail in chapter 3 of this thesis. Other barriers to PND treatments adherence can include stigma, long treatment sessions, sleep difficulties associated with infant sleep schedules and problems adjusting to and managing busy schedules of an infant balanced against other valued tasks (Kaltenthaler et al., 2008; O’Mahen et al., 2014). These barriers could be managed by ubiquitous technologies such as mobile phone health applications and thereby improve the wellbeing and lives of women with PND (Payne, Lister, West, & Bernhardt, 2015; Rincon et al., 2017).

The increase in the use of mobile phone applications may offer additional opportunities to provide support and may circumvent many of the difficulties that lead to poor adherence in PND. Previous studies highlighted that women receiving adjunct weekly phone calls, emails, and text message as support to treatment they received have found this helpful and reported high adherence rate (Broom, Ladley, Rhyne, & Halloran, 2015; Coates, Ayers, & de Visser,
2014; Cooper, Murray, Wilson, & Romaniuk, 2003; Cuijpers, Brannmark, & van Straten, 2008; O’Mahen et al., 2014; Turner, Chew-Graham, Folkes, & Sharp, 2010). An adjunct mobile application could be used to motivate postnatal depressed women to adhere to treatment and sustain treatment outcome in a long-term by providing guided support (O’Mahen et al., 2014). It could offer the opportunity to provide just-in-time support and resources to those that have particular needs for flexibility (Kaltenthaler et al., 2008). A mobile application for PND could enable personalised interaction in a more practical and nonintrusive fashion as well as specific treatment adaptation (O’Mahen et al., 2014). However, to the best of our knowledge, there is little research that informs the development of a theory-based adjunct mobile application intervention that could facilitate increased adherence to prescribed PND treatments.

1.2. Need for this research

Receiving treatment for PND and sustaining it over the long-term has been proven to be very difficult due to barriers such as struggles with transportation, childcare and non-adherence (O’Mahen and Flynn, 2008; Goodman, 2009; De Graaf et al., 2009). The impact of non-adherence to treatment is significant suffering in women and their families as well as the adverse effect on the infant (Danaher et al., 2012). Adjunct human support (ranging from a technical-level coach to a more highly skilled therapist) has been shown to increase adherence to PND treatments and a number of interventions have used supplementary telephone calls or other mediums to deliver this (Rojas et al., 2007; Milgrom et al., 2011; Danaher et al., 2012; O’Mahen et al., 2014; Broom et al., 2015). An adjunct mobile application for PND may well be a suitable platform for achieving increased adherence, self-management, greater guidance, sustained health outcome (Broom et al., 2015). Moreover, the high proliferation and ubiquitous nature of mobile applications present a new opportunity to enable effective and sustainable health behaviour change (Du, Venkatakrishnan, Youngblood, Ram, & Pirolli, 2016; Santo et al., 2016). However, to contribute to improving adherence to PND treatments, there is a need for change in behaviour. This includes studying the determinants of the adherence behaviour using accepted theories of human behavioural change.

Behaviour change is key to improving healthcare and health outcome. Behaviour may be those of patients, such as treatment adherence, health workers, the implementation of evidence-based practice, or of the general population (Cane, O’Connor, & Michie, 2012). Modifying people’s behaviour towards intervention is at the core of many efforts to improve the human condition, commitments and long-term maintenance of behaviour change (Ajzen, 2011). However, attempts to change behaviour and sustaining it over a long-term have been
very difficult (Wing et al., 2001). This is the case for women adhering to prescribed PND treatments and sustaining the effect of the treatments. As will be discussed in section 3.3, several studies have used pill counts, treatment deviation, and appointment monitoring to ensure increased adherence behaviour and sustained treatment effect. There is strong evidence that maternal beliefs and attitude to intervention can form barriers that can significantly reduce the uptake of treatment for PND (Danaher et al., 2012). Modifying people’s behaviour toward intervention is at the core of many efforts to improve the human condition, commitments and long-term maintenance of behaviour change (Ajzen, 2011). Research suggests that novel methods are needed to ensure long-term maintenance of behaviour change (Du et al., 2016). Theory-based interventions can explain attitude towards intervention, develop an understanding of the causal processes and mechanism, which accounts for observed behaviour change (Godin et al., 1992). Amongst these theories, the Ajzen (2011), Theory of Planned Behaviour (TPB) is considered one of the most effective behavioural change tools. This theory was chosen as the conceptual framework for this study because it is more appropriate for situations where individuals do not perceive themselves as having complete control over their behaviour as might occur in depressed women adherence to treatment and intentions to use a PND adjunct support (Ajzen, 2011).

The increase in the use of mobile phones and mobile applications may offer additional opportunities to provide support and may circumvent many of the difficulties that lead to poor adherence in PND (Michelle et al., 2014). Mobile phone health applications have the potential to collect behavioural data and enabled a wide range of behavioural change interventions (Goslin & Mason, 2015; Rincon et al., 2017). Using mobile technology for PND treatment support could promote prescribed treatment adherence and long-term maintenance of behavioural change. A set of requirements that will be used to inform the development of an adherence mobile application for PND is needed. The mobile application will have the potential to facilitate adherence to prescribed PND treatments. Furthermore, using the elements of TPB, AbovePostnatalDepression will be developed a a proof of concept and evaluated against the features of the ABC-W framework. The evaluation would identify whether the AbovePostnatalDepression as an adherence tool could help women with PND have control over their adherence behaviour as well as help facilitate sustained treatment outcome. It will also identify whether AbovePostnatalDepression could be used to motivate postnatal depressed women to adhere to treatment and sustain treatment outcome in the long-term. More importantnly, identify the possibility of the mobile application reducing procedural cost, time or efforts required by practitioner and women alike in ensuring increased adherence to prescribed treatments, but of paramount importance is the potential positive impact it could have on women’s
1.3. Significance of the research

This research deepens the understanding on the effects of adherence and the factors associated with adhering to PND interventions with the help of a literature review. This research also applies mixed-method approach to better identify factors that could have impact on PND treatments adherence in two concurrent studies with women and practitioners. This further expands the growing body of knowlegde on User Cnetered Design. Also, elements of TPB guided the investigations carried out in this research to better expand the knowlegde on adherence behavioural change. This research developed an Adherence Behavioural Change Wheel (ABC-W), this adds to the growing body of resources that could facilitate treatment adherence behavioural change for PND. A set of requirements were conceptualised from the ABC-W and these contributes to the knowlegede of requirements for the development of an adherence mobile application for PND, AbovePostnatalDepression. Finally, the study evalutes AbovePostnatalDepression and its potentials to facilitate women's PND treatment adherence behaviour.

1.4. Motivation

My interest in contributing to the development of an adherence intervention for PND sprung up after I completed my MSc Software Engineering on the topic, 'mobile application in the healthcare domain', which was a project developing a user-centred mobile application to support patients with PND. During the project process I became aware that although there are effective PND treatments, lots of women do not comply with prescribed treatments. Furthermore, non-adherence can have an adverse effect on a woman and their family. I did a literature search, and I was surprised by how little support was offered to increase PND treatment adherence. I also realised that there was no mobile application intervention that could facilitate treatment adherence behaviour. I decided this was an area I would be interested in working in. I decided to initiate the research presented in this thesis, as it would allow me to deepen my understanding of the PND treatment adherence factors. This would then, contribute to the development of an intervention that could facilitate adherence to prescribed PND interventions as well as improve the quality of life and wellbeing of women with PND, which was the major driving force behind this research.
1.5. Research questions, aims and objectives

This research aims to contribute to improvement in the adherence behaviour of women with PND towards prescribed treatments. It also aims to add to the understanding of the factors that could determine adherence to PND treatment. Previous research suggests that the more one knows about the influencing factors of a particular behaviour, the easier it will be to change that behaviour (Mirkuzie, Sisay, Moland, & Åstrøm, 2011). Knowing and addressing the adherence factors could not only positively impact a woman, but also her family and wider society too. To rigorously achieve these aims, this research is guided by a validated theory that is effective in changing health behaviour. Intervention strategies based on theories explain how the intervention works and allows effective intervention techniques to be identified (Williams, Michie, Dale, Stallard & French, 2005). A further aim would then be to develop a theory-based PND treatment adherence framework. The framework informs the development of an adjunct mobile application for PND. Importantly, the mobile application provides a proof of concept for the utilisation of the PND treatment adherence framework. Subsequently, this research investigates whether the framework will increase adherence to PND treatments.

In addition, to achieve these aims, the research project has four research questions. Question 1 and 2 are related to PND while question 3 and 4 is associated with the technological approach of this research. The research project also has four objectives.

Research question 1: What are the factors associated with adhering to PND interventions?

From research question 1, we have the first objective to investigate and establish the factors associated with adhering to PND interventions. An extensive literature review was conducted to expand our understanding on the effects of adherence and establish specific barriers associated with adhering to PND prescribed interventions. Two studies were carried out with women and practitioners to elicit factors that can have an impact on PND treatments adherence. The first study identified women’s adherence behavioural beliefs through the use of a questionnaire while the second study elicited practitioner’s views on intervention and techniques using interviews.

Research question 2: What should be the elements of a PND treatment adherence framework?
The second objective is to identify the elements, which are essential for the development of a PND treatment adherence framework. The findings from the review described in chapter 2 and 3 provide invaluable insights into variables that could potentially influence PND treatment adherence. This is combined with results from chapter 5 and 6 to generate elements of the PND adherence framework, Adherence behavioural Change Wheel (ABC-W). It is developed for the understanding of women’s beliefs and the knowledge and skills of practitioners for improving PND treatment adherence and sustained outcome and this is presented in Chapter 7 of this thesis.

**Research question 3**: What requirements can we infer from the PND adherence framework to inform the development of an adjunct mobile application?

In pursuit of answering this research question, we identified the third objective, which is to develop requirements to inform the development of an adjunct mobile application to facilitate adherence to prescribed PND treatments. The ABC-W framework informs the development of an adjunct mobile application prototype for PND, *AbovePostnatalDepression*. A scenario technique is used to conceptualise the usage characteristics and to infer a set of high-level requirements that could be used for PND adherence mobile application development. Detailed description and rationale for a set of high-level requirements are presented in chapter eight using the Volere shell, a requirement specification tool. The preliminary accessibility and usability features are considered for the development of a mobile application for women with PND. A set of adherence mobile application recommendations would be presented at the end of answering this question.

**Research question 4**: Can the adjunct mobile application change women’s PND intervention adherence intentions and behaviour?

The fourth objective is to investigate whether an adjunct mobile application can change women’s intervention adherence intentions and behaviour. A mobile application prototype *AbovePostnatalDepression* is developed to manage and monitor the use of multiple interventions. *AbovePostnatalDepression* is designed to manage the impact of symptoms so that changes are noticeable and to record prescription instructions. It also includes features to provide positive prompts to users for better communication, self-guidance; self-incentives and just-in-time support. Practitioners who are experts in delivering treatments evaluates the *AbovePostnatalDepression* as a useful tool to increase treatment adherence, greater guidance and self-monitoring of prescribed PND treatments. It also examines the influence of
the intervention on the TPB elements. Based on the TPB, the more favourable the practitioner's opinion is, the more likely women will intend to use the mobile application as an adherence tool (Ajzen, 2011; Knabe, 2009).

1.6. Research approach

The TPB is used as a theoretical lens to rigorously guide this research. This is because it is more appropriate for situations where women do not perceive themselves as having complete control over their behaviour (Ko et al., 2004). Researchers have long recognised the importance of theoretical models as a foundation when conducting a research project (Rossi, Lipsey & Freeman, 2004; Ajzen, 2011). Using frameworks, models and theories to design interventions allow for description, characterisation and contextualization of many potential factors towards increasing success of changing behaviour and ideally, allowing for possible replication of interventions with adaptable implementation strategies (Murphy et al., 2014). Theory-based interventions can explain attitude towards intervention, developing an understanding of the causal processes and mechanism, which accounts for observed behaviour change (Godin et al., 1992). As the research program described here is concerned with designing an intervention to change and facilitate adherence behaviour, a behavioural change oriented theory is therefore considered as essential. For optimum effectiveness, the use of a theory that resonated with the purpose of research informed this project.

1.6.1. Research methodology

This research is concerned with “what works”, the solution to the problem and therefore will use the pragmatic approach to understand the problem. Using the pragmatic method as will be discussed in chapter four allows the researcher to embrace different ideas, explanations and quality understanding of the research problem (Creswell, 2003). A mixed method approach is used for breadth, depth understanding and corroboration. Mixed method research allows the researcher to build a comprehensive picture: where using a combination of quantitative and qualitative methods allows the phenomenon to be described and explained broadly and comprehensively (Glogowaska, 2011). In this research, the quantitative and qualitative methods provide complementary insights that together give a comprehensive understanding of the factors that influences adhering to prescribed PND treatments than would have been achieved by either component alone.
1.7. Organisation of thesis

This thesis consists of eleven chapters. This chapter has outlined the research topic and why this research needed to be conducted.

The second chapter builds an understanding of PND. This includes an overview of the postnatal period, an introduction to PND, its symptoms, diagnosis, the risks factors and the prevalence. The impact of PND on the new mother, her infant and mother-infant interaction will be presented. This is followed by a discussion of the different types of intervention used for the treatment of PND. The purpose of this section is to give you an understanding of the interventions that are used to treat PND, their application, strengths and weaknesses. It also helped to identify the interventions that were integrated into the questionnaires and interview study used in chapter five and six of this thesis.

Chapter three describes adherence to treatment and examines the effects of adherence. It further identifies the factors associated with adhering to PND intervention, which justifies the aim and objectives of the research project.

Chapter four presents the overall methodology used in this research project. This includes a discussion on the goal of the study, followed by the theoretical foundation, which guided the study, the research philosophy, pragmatic mixed method, data management, and finally the ethics.

Chapter five identifies women’s adherence behavioural beliefs using a questionnaire. This knowledge informs the development of a PND adherence model.

Chapter six, includes practitioners’ view of interventions, techniques and the potential use of a mobile application as additional support for the treatment of PND.

Chapter seven describes the development of the ABC-W framework. It includes the design process and examines the elements of the ABC-W and how it could potentially help create an effective treatment adherence behavioural change.

Chapter eight provides a detailed description and rationale for a set of high-level functional requirements for an adjunct mobile application to facilitate adhering to prescribed PND treatments.
Chapter nine concentrates on the design and implementation of a mobile application AbovePostnatalDepression prototype.

Chapter ten evaluates the potential of using an adjunct mobile application as a useful tool to increase treatment adherence, greater guidance and self-monitoring of prescribed PND treatments. It further examines the influence of the intervention on the TPB constructs.

Chapter eleven draws together the research findings, the implications and impact of the research and outlines the contribution to knowledge. Moreover, it states the limitations of the research in this thesis and future research possibilities.
2. Postnatal Depression and intervention to support the wellbeing of women

2.1. Introduction

In order to build an understanding of PND, this chapter will give an overview of the postnatal period. This will be followed by an introduction to PND, its symptoms, diagnosis, the risks factors and the prevalence. The impact of PND, effect on a new mother, her infant and mother-infant interaction will be discussed. We then provide a discussion of the different types of intervention used for the treatment of PND. The purpose of this section is to give the reader an understanding of the interventions that are used to treat PND, their application, strengths and weaknesses. It is also intended to help identify the interventions that could be integrated into the questionnaires and interview study used in this research project. A full account of these studies is discussed in chapter five and six of this thesis.

2.1.1. Postnatal period

The postnatal period is a crucial period when a new mother undergoes the transition into motherhood and includes the development process for infants. The mother will go through the procedure of adapting to her new role in the family. However, the stress and daily pressures of raising children could have an impact on the wellbeing of a postnatal mother. Previous studies show that many women say they struggle to be "perfect mothers", they cannot sometimes cope or feel fulfilled in their roles (Beck & Gable, 2003). These feelings are sometimes attributed to possibly being overwhelmed by the responsibility of caring for their children (Beck, 2002b; Knudson-Martin & Silverstein, 2009). The mother is required to understand the needs of her new baby, interpersonal and personal adaptation. For example, she needs to understand and adapt to the constant demands of infant feeding, napping schedules, crying and putting her infant to sleep (Rai, Pathak, & Sharma, 2015). This will likely mean that the mother will inevitable incur lack of sleep given her sudden responsibility potentially 24 hours a day. Some women may miss the freedom they had experienced before the baby arrived (Dennis & Stewart, 2004). Additionally, studies have reported that the new mother is expected to undergo some physical, emotional, social and psychological changes (Beck, 2002b). These changes might include tiredness, mood swings, problem concentrating or making decisions, feeling guilty, loss of appetite or increased appetite and lack of sleep (Beck, 2002b; Knudson-Martin & Silverstein, 2009).
The changes in lifestyle associated with childbirth, in some cases, can contribute to new mothers’ stress (Stewart et al., 2003). In 2006, Milgrom and colleagues conducted a comparison of data on parenting stress, and they found that parenting stress does not resolve itself quickly with the passage of time. In other studies, it is believed that parenting stress could develop into emotional upheaval, changes in behaviour and then can lead to several episodes of major or minor depression (Morrell, 2006; Stewart et al., 2003). It is, therefore, conceded that the postnatal period with stressful life events might lead to postnatal mood disorders. This affective disorder ranges in severity from the early maternity baby blues to postpartum psychosis, which is a severe illness affecting approximately 1% of mothers (Dennis, 2004). These mental disorders can be differentiated by prevalence and clinical presentation, including time of onset, severity, length of impairment and recurrence (NHMRC, 2000). We now consider these three types of childbirth mood disorder in turn, with more detailed consideration of PND, as this is the subject of the research project.

2.1.2. Baby blues

According to the literature, 15-85% of women experience transient “baby blues” within the first two weeks following delivery (Heron, Craddock, & Jones, 2005; Pearlstein, Howard, Salisbury, & Zlotnick, 2009). Baby blues is a disorder that is characterised by mild dysphoria, and symptoms can include heightened sensitivity, tearfulness (often without associated sadness), poor concentration, anxiety, and irritability (Molyneaux, Howard, McGeown, Karia, & Trevillion, 2014). Although women may find it distressing, symptoms of baby blues usually resolve spontaneously within 10-14 days without being considered a cause of concern or requiring specific treatment apart from the woman needing help. Help can be needed to understand the situation, empathy, how to get support, gaining mother crafting skills, practice and knowledge of the postnatal period and childcare (Heron et al., 2005). If the symptoms of baby blues continue longer than two weeks, this may indicate the beginning of PND and research suggests immediate health care attention (NICE, 2014).

2.1.3. Puerperal Psychosis

In rare cases, women experience the sudden onset of psychotic symptoms following childbirth, a severe mood disorder known as Puerperal Psychosis (PP) (Doucet, Jones, Letourneau, Dennis, & Blackmore, 2011; Veen et al., 2016). PP is the most extreme and least common form of postnatal mood disorder, affecting about 0.1% to 0.2% of all recent mothers (Munk-Olsen, Laursen, Pedersen, Mors, & Mortensen, 2006). In the majority of cases, the onset is
rapid and usually presents within two weeks postpartum (Doucet et al., 2011). Early symptoms can include insomnia and mood fluctuation, followed by more severe mood symptoms such as mania; delusions; hallucination; depression; psychotic and cognitive symptoms; but exceptionally serious risk of suicide and infanticide in some severely depressed mothers (Doucet et al., 2011; Sit, Rothschild, & Wisner, 2006; Spinelli, 2009; Veen et al., 2016). Furthermore, it is a widely held view that approximately 4% of women with PP commit infanticide (Sit et al., 2006; Veen et al., 2016) and this usually requires hospitalisation of the mother (Pitt, 1968). Immediate intervention is necessary for women with PP, because, if left untreated the disorder may have tragic consequences. However, with prompt intervention there is greater potential for these women to make a full recovery (Rosinger & Kautz, 2012).

2.2. Postnatal Depression

PND can be defined as a non-psychotic depressive episode which meets standardised diagnostic criteria for a minor or major depressive disorder, beginning in or extending into the postnatal period, and is usually defined at up to 12 months postpartum, (Cuijper et al, 2008; Evans, Donelle & Hume-Loveland, 2011; Gibson et al., 2009; Hewitt et al, 2009; Lewis, 2004; Stevenson et al, 2010). There is evidence that PND affects 10–15% of mothers and can lead to cognitive and emotional disturbance in the baby alongside the negative effects on the mother (NICE, 2015). According to many in the field, PND can affect the life of not only the postnatal mother, but it can have a negative impact on her family (Morrell, 2006; Webster, 2002). This negative impact could include poor family functioning, mother-baby interactions and the long-term emotional and cognitive development of the baby especially when depression occurs in the first year of life (Beck, 2002a; Cuijpers et al., 2009; Hewitt et al., 2009; Knudson-Martin & Silverstein, 2009; Murray, Cooper, Wilson, Romaniuk, & Ay, 2003). More specifically, it can affect the mother’s ability to cope with the care of an infant, limit her capacity to engage positively with her family life, her social interaction and particularly her parenting practices (Glover et al., 2002; Hewitt et al., 2009; Morrell, 2006; Tsivos, Calam, Sanders, & Wittkowski, 2015).

2.2.1. Symptoms of Postnatal Depression

Pitts (1968) criteria for the presence of depression following childbirth, still used by researchers (e.g. Beck, 2001; O’Mahen et al., 2014) are that women should present depressive symptoms. These symptoms should have developed since delivery. They should be unusual in their attitude and to some extent disabling, and they should have persisted for
more than two weeks. Women suffering from PND commonly have hostile feelings towards their infants; suicidal feelings; low self-worth; insomnia; tearfulness; suicidal thoughts; loss of libido and fatigue or irrational fear. They will frequently experience consuming guilt specifically related to the ability to care for the newborn or other children (Beck, 2002b; Dennis & Chung-Lee, 2006; Knudson-Martin & Silverstein, 2009; Miniati et al., 2014; O'Mahen et al., 2014). PND is often described by sufferers as a “living nightmare” that is filled with uncontrollable anxiety and obsessive thinking (Beck & Gable, 2003). When assessing depression, most of the symptoms listed above are used as indicators for PND.

2.2.2. Diagnosis

There is a growing body of literature that recognises the need to screen all women for their risk of developing PND (NICE, 2014). This is because untreated depression and other mood disorders can have a devastating adverse effect on sufferers (Beck, 2002b). Early recognition is one of the significant challenges in dealing with this mood disorder. Research reported that only 49% of mothers who felt severely depressed sought help (Beck, 2002a). Early screening, diagnosis, and management are essential and must be treated as a mandatory part of postnatal care. Becks and Gable, (2000) emphasised in their research that early and accurate identification of women experiencing PND could help reduced a real barrier to mental health care for depressed mothers and their families in the community. The diagnosis of PND can be challenging because of changes in sleep patterns, changes in appetite and excessive fatigue being a routine for women after delivery (Cooper, 2003; Pearlstein et al., 2009).

PND screening strategies have been advocated as a remedy to the problem of women remaining undiagnosed and yet suffer from PND (Hewitt et al., 2009). In 2014, NICE recommended that at 10-14 days after childbirth women should be assessed for PND. However, successful screening for PND will require tools that have been validated for use during the postnatal period to assist with systematically identifying patients (Thombs et al., 2014). The most frequently used self-report instruments for measuring PND are as follows: Edinburgh Postnatal Depression Scale (EPDS), Beck Depression Inventory (BDI) and Postpartum Depression Screening Scale (PDSS) (Beck & Gable, 2001). Although, some possible limitations of these scales include, some percentage false positive results (Mauri et al., 2010; Zubaran, Schumacher, Roxo, & Foresti, 2010).

It is assumed that up to 50% of all PND cases often go undetected due to lack of proper screening, or to the shame and loneliness that makes a woman hide her depressed state from
people around her (Cuijpers et al., 2009; Wood, Middleton, & Leonard, 2010). It is known that primary health care professionals in routine clinical practice identify less than 50% of the cases of PND (Hewitt et al., 2009). Additionally, 50% of women with PND, are not adequately diagnosed, possibly because health professionals have not sufficiently assessed their depressive symptoms (Sit et al., 2006). Consequently, this raises controversial debate in the literature over the accuracy of PND screening tools (Thombs et al., 2016). However, this is beyond the scope of this research project.

2.2.3. **Edinburgh Postnatal Depression Scale**

Cox and colleagues developed the EPDS in 1987 to screen for PND (Cox, Holden, & Sagovsky, 1987). The EPDS is a self-report scale that holds a high validity and reliability in screening for PND (Wood et al., 2010). EPDS have been extensively used and proven to be an efficient and effective way of identifying women at risk for PND (Green, 2005). Recent evidence shows that EPDS is by far the most well-known and evaluated PND identification strategy (Hewitt et al., 2009; Zubaran et al., 2010). This tool consists of 10-item self-report statements with four rating scales ranging from 0 (yes, most of the time) to 3 (no, not at all). Questions are related to anxiety, feelings of sadness, reduced enjoyment of activities, self-blame, difficulty sleeping, and thoughts of self-harm (Wood et al., 2010). The scale is brief and easy to administer, and research evidence supports its validity regarding detection, specificity, sensitivity to change over time and predictive power (Hight & Drummond, 2004). Existing studies on the accuracy of EPDS were conducted on a sample too small to precisely estimate accuracy (Thombs et al., 2014). Additionally, it is believed that EPDS has its disadvantages (Murray et al., 2003; NICE, 2006; Shakespeare, Blake, & Garcia, 2003). One of the disadvantages is that it is not a substitute for a full psychiatric assessment because, it does not predict PND and nor does it provide a measure of severity; it purely indicates the likelihood of depression (Hanna, Jarman, & Savage, 2004).

2.2.4. **Beck Depression Inventory - II**

The Beck Depression Inventory (BDI) has been one of the most frequently used general depression instruments in PND research (Beck & Gable, 2001). The BDI has been consistently revised to make the symptoms content corresponds more closely to the diagnostic criteria of the American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorder (DSM-IV). The recent revision is the BDI-II tool, a 21-item self-report rating inventory that measures characteristic attitudes and symptoms of depression (Beck, 1996). A 4-point scale
is used with scores ranging from 0 to 3, this is arranged in increasing severity about a particular symptom of depression, aligning the BDI–II with the DSM–IV criteria. Higher total scores indicate more severe depressive symptoms. The high consistency and reliability of the BDI-II have been demonstrated in the literature (Beck & Gable, 2001).

2.2.5. **Postpartum Depression Screening Scale**

The Postpartum Depression Screening Scale (PDSS) is a self-rating scale with summative scoring that is conceptually based on a series of qualitative data collected and analysed in studies undertaken by Beck, Beck and Gable (Beck, 1996; Beck & Gable, 2000; Hanna et al., 2004). The scale includes dimensions covering sleeping, eating disturbances, anxiety, insecurity, emotional liability, and cognitive impairment, loss of self, guilt, shame, and contemplating harming oneself. PDSS is a 5-point Likert scale with scores ranging from 35 to 175 that is used to indicate women’s degree of agreement or disagreement with each statement (Zubaran et al., 2010). All of the items on the PDSS were created using actual quotes from women who had participated in research on PND (Beck & Gable, 2000). Hanna and colleagues (2004) reported a comparative performance of the PDSS and the EPDS with 150 women and the results show that PDSS achieved the highest combination of specificity and sensitivity, concluding that it was a useful instrument in identifying minor and major depression.

2.2.6. **Risks factors for developing Postnatal Depression**

There has emerged from the literature no strong single risk determinant for PND, but rather a series of broadly defined factors. Among those most frequently cited are: personal history of depression; depression during pregnancy; difficulties in the relationship with your partner; a lack of practical and emotional support; lack of social functioning; and an accumulation of stressful life events (Carter, Frampton, & Mulder, 2006; Hewitt et al., 2009; Xie, He, Koszycki, Walker, & Wen, 2009). Other factors that may be related to a higher risk of PND are: environmental stressors; a family history of psychological problems; single parenthood; having severe “baby blues”; having a negative view of life; labour and delivery complications for mother or baby; depressed partners; problems with the baby’s health (including prematurity); and having a “difficult” baby (easily upset temperament or problems with feeding, sleeping, settling behaviour) (Beck, 2002b; Carter et al., 2006; O’Hara, Stuart, Gorman, & Wenzel, 2000). Furthermore, where mothers have left their employment for childbearing, this can often
contribute to a lower social and economic situation. Hence, the risk of them also being affected by PND. It is a widely held view that the physiological role transition related to motherhood has been shown to be specific risk factors for the occurrence of depression during the postnatal period (Miniati et al., 2014).

2.2.7. Prevalence

A meta-analysis of 59 studies involving nearly 13,000 subjects showed the overall prevalence of PND to be 13% of postnatal women (Evans et al., 2012; Morrell, 2006). Another critical finding reports that each year, approximately 70,000 women experience PND in the United Kingdom, which is about 10% of those giving birth each year (Glover et al., 2002). Similarly, a study demonstrated that at six months postpartum, the prevalence of PND in the UK is 9.1% (Stevenson et al., 2010). Additionally, NHMRC (2000) showed that as there are about 250,000 births each year in Australia, at least, 25,000 to 50,000 women which are around 15% of all childbearing women are likely to be affected by PND. Researchers, using the PDSS (Beck & Gable, 2000), the EPDS (Cox et al., 1987), and the BDI-II (Beck, 1996), reported a prevalence rate of 12% (Leahy-Warren & McCarthy, 2007). This means that there may be significant variance between study samples with implications for generalisability of research findings. However, for this study, we can infer that the prevalence rate of PND after childbirth is between 10% and 15%. It is, therefore, evident that there are high prevalence rate and occurrence of PND in mothers following child delivery (Scope et al., 2013).

2.2.8. Impact of Postnatal Depression on the mother

Studies have investigated the adverse effect of PND on a mother after child delivery, and some factors recur in these studies (Beck, 2002b; O’Mahen et al., 2012; Zlotnick, Tzilos, Miller, Seifer, & Stout, 2016). The gravity of PND can reinforce the disabling sense of isolation, guilt, helplessness and hopelessness that frequently characterise the depressed state. Like other episodes of depression, PND affects a postnatal woman’s feeling about herself, her interpersonal relationships and she may be functioning only minimally in her role as a mother (Beck, 2002a). Furthermore, the depressed state can be compounded by family, friends and healthcare professionals who may sometimes seem insensitive to their suffering and reluctant to listen and understand a mother’s unhappiness. Some crucial other problem areas faced by depressed mothers are getting help with childcare; coping as a mother; limited activities that will help to lift mood, e.g. seeing friends; and obtaining practical support in baby care from the
partner, relatives and others (Appleby et al., 2003). Notably, the effect of the above problems on the depressed mother might cause non-adherence to PND treatments.

### 2.2.9. Impact of Postnatal Depression on infant

PND is associated with the long-term disruption of early infant physical, emotional and cognitive development of the infant (Parsons, Young, Rochat, Kringelbach, & Stein, 2012). Serious consequences of maternal depression on children include an increased risk of accidents; lower weight percentile; impaired mental and emotional development; difficult temperament; poor self-regulation; low self-esteem; sudden infant death syndrome; an overall higher frequency of hospital admissions and long-term behavioural problems (Boath, Bradley, & Henshaw, 2006; Cuipers et al., 2009; Glover et al., 2002; Grace et al., 2003; Miniati et al., 2014; Morrell, 2006; Forman, Videbech, Hedegaard, Dalby Salvig, & Secher, 2000). Crucially, the first year is an important period for infants to develop adaptive self-regulatory skills that can be promoted by sensitive and responsive caregiving (Tronick & Reck, 2009). Research using face-to-face video interaction paradigm has demonstrated that infants of mothers with PND are less positive than non-depressed mother-infant dyads (Tsivos et al., 2015). The mother’s mental health may play an essential role in how well she can perform in her roles. Infants whose mothers are depressed tended to be fussier and make fewer positive facial expressions and vocalisation (Beck, 2002a).

### 2.2.10. Impact of Postnatal Depression on mother-infant interaction

A significant finding from research is that PND can adversely affect mother-infant interaction as well as infant attachment and parenting practices (Hewitt et al., 2009; Morrell, 2006; Parsons et al., 2012; Rai et al., 2015). Parenting difficulty can be associated with depressed women’s poorer responsiveness to their infants’ cues, thus, interfering with the quality of the dyadic relationship and process of attachment (Fitelson, Kim, Baker, & Leight, 2011; Rai et al., 2015; Tsivos et al., 2015). The negative effects of PND are also characterised either by hostile and intrusive behaviour, by withdrawal and disengagement with infants or displayed less affectionate behaviour (Beck, 2002a). The quality of early mother-infant relationship and child cognitive development has been evaluated in a study by Murray and colleagues (2003), 193 women with PND and their children were assigned to treatment groups and assessed at 4.5, 18 and 60 months postpartum. This research found that women had problems with regards to infant attachments and the practical management of infant’s need even after
treatment. The cognitive and emotional impact of PND on the infant is due to the negative effects that PND symptoms can have on mother-infant interaction (Boath et al., 2006). Thus, knowledge on the impact of PND in the context of parenting difficulties is essential to the development of additional support for a better PND intervention outcome.

2.3. Interventions to support the wellbeing of women with Postnatal Depression

There are a number of interventions available to support the wellbeing of women with PND. The effectiveness of these interventions has been the focus of lots of research in the world for some reason. Some of these reasons could be related to the adverse consequences of PND for the mother, the infant, the mother-infant relationship and improved quality of life after childbirth. This section briefly describes different kinds of interventions and approaches used to support the wellbeing of women with PND, and as mentioned earlier these interventions will be integrated into the questionnaire and interview used in this research.

2.3.1. Pharmacological interventions

Several studies provide evidence supporting the essential role of pharmacological interventions in supporting the wellbeing of women with PND. This section will review pharmacological interventions, the effectiveness and adherence to this treatment option. Within the UK, depression in primary care is usually treated with antidepressants as a significant pharmacological intervention (Kaltenthaler, Parry, & Beverley, 2004; Wisner, Parry, & Piontek, 2002).

2.3.1.1. Antidepressants

Antidepressants are drugs that treat the symptoms of PND, and there is evidence to support its efficacy when used as prescribed (NHMRC, 2000). To evaluate the effectiveness of antidepressants in the treatment of women with depressive symptoms, one study compared antidepressants and placebo for the treatment of PND in an 8-week study (Yonkers, Lin, Howell, Christopher Heath, & Cohen, 2008). Seventy women qualified for the study and 31 completed between seven and eight weeks of treatment. Women were randomised to either a placebo group or to take an initial dose of 10 mg of paroxetine which was then further adjusted to 30mgs and 40mgs according to health improvements especially if depressive severity were less than 30% by week 4 and 6. The results indicated that there was a significant
improvement in overall clinical severity found for paroxetine group compared with the controlled group. However, the study was restricted by limited sample size and high attrition rate complicated the interpretation of the findings. Adherence to intervention in this study was implemented using pill count at each follow-up visit, and those who took less than 80% of the prescribed pills were designated as noncompliant for that visit and were counselled regarding compliance or removed from the study. Some other women were removed from the study because of their capacity to care for their infants as well as themselves.

In another study, Bloch et al. (2012) determined the efficacy of antidepressants in the treatment of mild to moderate PND and the possible advantage of the combination of an antidepressant and psychotherapy an 8-week. Forty-two women diagnosed with mild to moderate severity postnatal depression according to DSM-IV-TR criteria were enrolled in an 8-week, randomised, double-blind, and placebo-controlled study. Participants received 12 sessions of focused Brief Dynamic Psychotherapy (BDP) concurrently with 8-week sertraline or placebo treatment, followed by a four-week open phase. While this study demonstrated a significant clinical improvement in the treatment of mild-moderate PND with focus on BDP, it should be noted that seven patients discontinued medication between weeks 4 and 8, 3 (43%) from the placebo and 4 (57%) from the active group. Discontinuation was due to lack of motivation (n=4: placebo group, n=2; sertraline group, n=2) and clinical deterioration (n=3: placebo group, n=1; sertraline group, n=2). A pill count was conducted to monitor compliance. While the results indicate a very low attrition rate, it is possible that the therapeutic alliance achieved owing to the psychotherapy provided good support leading to high compliance. The study was not adequately powered to show adjunctive drug effect that a much larger study with large sample size may have been able to detect and this then limits the conclusions that can be drawn.

Molyneaux et al. (2014) reviewed studies on the effectiveness and safety of antidepressant in comparison with placebo or treatment as usual in six trials with 596 participants. Significant improvement was seen in the antidepressant groups, but a substantial proportion of women experienced side effects. There was no evidence to show that the benefits of antidepressants persist beyond eight weeks. This study indicates that there were high attrition rate and dropout which made it difficult to detect a significant treatment effect. While antidepressants are a very effective treatment, but how they work to improve adherence is not fully understood.
2.3.2. Psychological support interventions

Partly in response to concerns about the potential adverse outcome of antidepressants, over the past 25 years, there has been a move towards increasing the availability of psychological interventions (Morrell, 2006). Postnatal mothers consistently indicate that they prefer therapy to antidepressant because of concerns over the safety when breastfeeding (Hou et al., 2014). NICE recommend a range of psychological intervention in different circumstances based on their review of the evidence (Tsivos, Calam, & Matthew, 2011). Psychotherapy remains one of the most effective treatments and supports for PND, such as Cognitive Behavioural Therapy (CBT), Interpersonal Therapy (IPT), Problem Solving Therapy (PST) and Wellbeing Therapy (WB). Several studies support the clinical usefulness of individual and group psychotherapies for PND (Kalententhaler et al., 2008b; Proudfoot et al., 2004).

2.3.2.1. Cognitive Behavioural Therapy

Cognitive Behavioural Therapy (CBT) is a psychotherapy that focuses on managing negative thoughts and behaviour in depression (Kaltenthaler et al., 2002; Morrell et al., 2009). The history of CBT can be divided into three overlapping but distinct generations (Hayes, 2004). The first generation, commencing with the ground-breaking work of Eysenck (1952), Skinner (1953) and Wolpe (1958), spanned the 1950s and into the 1960s, and developed mainly in reaction to the perceived weaknesses of psychoanalytic theory and therapy (Herbert & Forman, 2009). CBT is strongly adapted to treat PND through several approaches such as CBT in routine care, online CBT and group CBT. Several studies propose CBT as the most widely accepted and effective support for women with PND (Milgrom et al., 2011; Milgrom, Negri, Gemmill, McNeil, & Martin, 2005a; Murray et al., 2003). However, it is unclear whether this intervention has content specific to the postnatal period and demanding schedules (O’Mahen et al., 2014). There is an increasing need to understand which modification and aspects of CBT treatment that will be more effective for women with PND. This is because in previous findings women expressed concerns about treatment lacking content specific to the postnatal period, thus leading to poor compliance (O’Mahen et al., 2014). CBT programmes cannot always be seamlessly individualised for specific treatment conditions, thereby reducing the acceptability of programme to an individual with particular requirements (O’Mahen et al., 2014).

Milgrom et al., (2005) compared CBT in individual counselling, group counselling and treatment as usual in women with PND. The programs consisted of nine, weekly, 90-minute
sessions with mothers, and three sessions involving partners. Although, the research suggests the clinical efficacy of CBT in PND, improvement in depressive symptoms were not maintained at 12 months follow up. They suggest that being delivered on a one to one basis may maximise the benefits of CBT. A similar study compared the long-term effect of CBT in a controlled trial with routine primary care. At 4.5 months treatment marked a reduction in depressive symptoms, however, at 9, 18 and 60 months the positive benefits of the treatments were no longer apparent, and there was no evidence of reduction of subsequent episodes of postnatal depression (Cooper et al., 2003). Honey, Bennett, and Morgan (2002) reports that group-based psycho-education, including cognitive-behavioural techniques, was superior to routine care. Chabrol et al. (2002) used ‘preventative’ CBT, followed by both CBT and psychodynamic therapy for women who developed major depression. Both prevention and intervention proved effective. Research comparing the outcome of women with PND treated with modified CBT to ideal standard care offered by Early Childhood Nurse (ECN) identified that ECNs appear to be a more valuable resource in the treatment of PND (Prendergast & Austin, 2001). Milgrom and colleagues (2011) examined the effectiveness of counselling informed by the principles of CBT and delivered by trained GP alone or delivered by a trained nurse or psychologist. Their findings suggest that counselling CBT was most effective when delivered by healthcare nurses. Although in most cases, mental health specialists deliver CBT, but it seems apparent that there is lack efficient delivery of this intervention. CBT intervention delivery might be limited owing to cost, waiting lists and availability of practitioners (Jones et al., 2013; Stevenson et al., 2010).

2.3.2.2. Interpersonal Therapy

It has been confirmed that many interpersonal disruptions associated with the postnatal period can be alleviated with Interpersonal Therapy (IPT) because it is problem-focused and can be incorporated easily into family practices (Grigoriadis & Ravitz, 2007). IPT focuses on goals of modifying interpersonal disputes, role transitions, and bereavement, which are relevant for women with PND (Boath & Henshaw, 2001; NHMRC, 2000). Mainly based on Sullivan’s Interpersonal Theory and on Bowlby’s Attachment Theory, IPT can be seen as indirectly addressing problems and issues faced by women within the therapeutic frame (Klier et al., 2001; Miniati et al., 2014). Major limitations of IPT include the training of healthcare workers and time commitment required from both physicians and patients. Although IPT helps women with PND develop a more balanced view of each role such as renegotiating time commitments and responsibilities to adapt to new time, emotional constant while balancing needs and
wishes in her multiple roles. However, research has not shown the procedures about the consistency of support especially in the absence of healthcare workers.

In a study to evaluate the efficacy of IPT for PND, 120 women were screened using the DSM-IV and randomised to the intervention group of 12 weeks of IPT or waiting-list control (WLC) (O’Hara, 2000). More women in the IPT group had a significant increased rate of recovery, and greater decrease in scores on the BDI and the Hamilton Rating Scale for Depression (HRSD) than the women in the WLC group (37.5% vs 13.7%). Klier et al., (2001) treated 17 women fulfilling the DSM-IV criteria for PND using the group IPT approach and their results showed that depressive disorder decreased significantly comparing the pre-treatment and the post-treatment period. An analysis of individual 21-item HRSD score profile revealed that 10 of 17 women (58%) achieved full remission (Post-treatment score > 9), 5 women (29%) demonstrated a partial remission (score decrease > 50%) at the end of treatment, and only two women (11%) did not improve. Nonetheless, despite their improvement, lack of control groups and possible bias in therapist’s assessments limits the conclusion that can be drawn. Furthermore, Zlotnick et al. (2001) provided the evidence that IPT was effective in reducing the occurrence of depressive disorder among financially disadvantaged women. However research suggested that IPT alone is not sufficient for the treatment of depression, but a combination of medications and possibly hospitalisation should be considered in extreme cases (Grigoriadis & Ravitz, 2007).

### 2.3.2.3. Problem Solving Therapy

Problem Solving Therapy (PST) has shown to be effective for PND and common mental health problems (Chibanda et al., 2011; van’t Hof, Stein, Marks, Tomlinson, & Cuijpers, 2011). PST assumes that depression is often caused by practical everyday issues and aims to teach people better ways to cope with such problems and this is achieved by setting goals and minimising feelings of incompetence and distress (Mynors-Wallis, 2001; van’t Hof et al., 2011). In a RCT, group problem-solving therapy delivered by peer counsellor was compared with pharmacotherapy for the treatment of PND among women found to be depressed 6 to 8 weeks after childbirth (Chibanda et al., 2014). Their study demonstrated that group PST appeared acceptable and more efficient compared to pharmacotherapy in the treatment of PND but will require regular and reliable training and supervision. This is further supported by Van't Hof et al., (2011), they carried out five weeks PST in a booklet format delivered individually or in a group. Their research indicated that group delivery of PST had lower dropout rate than individual delivery. In these studies, there is substantial evidence to show that PST is effective.
for the treatment of PND. However, the active components of PST are unclear (Chibanda et al., 2014). The long-term impact of PST on the wellbeing of postnatal depression mothers and benefits for infants has not been explicitly stated.

### 2.3.2.4. Well-being Therapy

Well-being Therapy (WBT) builds on Ryff’s (1989) six dimensions of psychological well-being: autonomy, environmental mastery, positive relations, and self-acceptance (Ruini, 2014). WBT focuses on the emotional wellbeing and refrains from explaining from the outset to the patient its rationale and strategies but relies on her progressive appraisals of positive self. Moeenizadeh and Salagame (2010) compared CBT and WBT regarding enhancement of wellbeing and reductions of symptoms. This study emphasised on the usefulness of the approaches and found a significant improvement in depressive symptoms. Ruini (2009) research adapted WBT and identified that psychotherapies that bring the person out of the negative functioning are one form of success but facilitating progression towards the restoration of positive is quite another. Although previous research found to reduce depressive symptoms (Fava & Ruini, 2003), further study appears to be warranted in understanding the effectiveness of WBT to support women suffering from PND.

### 2.3.3. Multicomponent support interventions

A variety of techniques are available to support PND, and these include peer support, listening visits and educational programmes. Firstly, women who have experienced similar problems often conduct peer support groups with the potential to prevent PND. In light of this, Dennis et al. (2014) conducted a study to evaluate the effects of telephone-based support in the prevention of PND. In this trial, 701 mothers were recruited and randomised to control and intervention groups. Results indicated that support provided by peers might be an effective intervention that reduces the risks of PND at 12 weeks after childbirth. However, these techniques need to be evaluated by extensive research.

Also, the potentials of listening visits by health visitors have been promoted for the treatment of PND (Morrell et al., 2009). There is evidence that providing support, such as “listening visits”, can lead to better obstetric outcomes and better psychosocial adjustment in mothers (NHMRC, 2000). In some areas in the UK health visitors are trained to give listening visits by utilising principles of non-directive counselling (Boath et al., 2004). Osman and colleagues (2014) assessed the impact of postnatal support film and a 24-hour telephone hotline service
to reduce postnatal perceived stress among first-time mothers. Results show that these interventions can be easily implemented and could have a significant impact on the mental wellbeing of new mothers. For these women, time-limited supportive counselling may be insufficient and longer-term support. Effects of intervention were not related to practical management of her infant and variable tasks.

Educational programme has been offered and accepted to treat PND. Ho et al. (2009), provided evidence that women who receive discharge education intervention on PND are less likely to have high depression score compared to the control group at three months. A British comparative study of 45 women found that women with probable PND in psycho-educational group scored significantly lower on the EPDS compared with a group of women receiving usual care (Honey, Bennett & Morgan, 2002). Navaie-Waliser et al. (2000) also found that high-risk mothers provided with more intensive educational support by home visitors were less depressed, and the frequency of home visits is an important component in improving women’s psychological health.

2.4. Summary

The chapter began with a brief description of the postnatal period, introduction to PND, symptoms, diagnosis, the risk factors, and the prevalence of PND was introduced to build an understanding of the mental disorder. A discussion of the adverse effect of PND on the new mother, her infant and mother-infant interaction was provided. It continued with an outline of the different type of intervention used for the treatment of PND. The effects of the various interventions and support techniques for PND in the studies were consistent. However there is significant emphasis on the dropout rate, high attrition, delivery and non-adherence. For example, some women were excluded from the study because they were non-compliant, while some dropped out due to lack of motivation. The wellbeing of these women after exclusion or dropout remains questionable. Thus this finding indicates that there is need to be highly vigilant about the potential impact on non-adherence to interventions on a depressed woman and her family. The studies have shown clearly that efforts have been made to increase the efficacy of intervention delivery that could facilitate availability and access to appropriate treatment for PND (Boath et al., 2004, O’Mahen et al., 2014). It is however disappointing that a lot of depressed women even when there are effective intervention delivery options remain without treatment or poorly comply (Dennis, & Chung-Lee, 2006, O’Mahen & Flynn, 2008; Goodman, 2009). These may be associated with practical difficulty related to the demands of childcare, parenting schedules, limited access to intervention, struggles with transportation, or
overwhelming responsibilities (McCarthy & McMahon, 2008), or perceived stigma (O'Mahen, 2014). These factors will be integrated and evaluated in the studies describes in chapter eight, nine and ten of this thesis.
3. Chapter Three: Adherence to Postnatal Depression interventions

3.1. Introduction

This chapter will examine the effects of adherence and the factors associated with adhering to PND interventions. This section will justify and explore the aim and objectives of the research project. As discussed in chapter two, studies have suggested effective pharmacological and psychological interventions for the treatment of PND (Graham, Franses, Kenwright, & Marks, 2000; Kaltenthaler et al., 2008b; Misri, Reebye, Corral, & Milis, 2004; Molyneaux et al., 2014; Yonkers et al., 2008). However, the postnatal period still presents specific barriers to adequate improvement in depression, and a large number of women remain without treatment, poorly adhere to the prescribed intervention or show only moderate improvement in depression (Boath et al., 2004; O'Mahen et al., 2014).

Adherence is defined as the extent to which a person’s behaviour conforms to medical or health advice (Bruer, 1982; Pampallona et al., 2002). A systematic review on women’s adherence in the treatment of postnatal depression confirmed that it is a major problem (Omisade et al., 2017). Similarly, it is reported that one in three patients suffering from depression do not complete their prescribed treatments (Pampallona et al., 2002). Receiving treatment for PND and sustaining it over the long-term has been proven to be very difficult due to barriers. These barriers could include struggles with variable infant feeding demands and napping schedules that may interfere with regular appointment attendance (O’Mahen et al., 2015). Some women face difficulty in looking after their children due to impaired state of mind; maternal sleep difficulties that may be associated with infant sleep schedules and problems adjusting to and managing the infant needs balanced against other valued tasks (de Graaf et al., 2009; Goodman, 2009; O’Mahen et al., 2015; O’Mahen & Flynn, 2008). Poor patient-doctor relationship, negative experiences with seeking help in the past, long waiting list for treatments, location convenience, and perceived stigma can also lead to women avoiding treatments and interfere with the ability of women to attend regular scheduled appointment (Christensen, Griffiths, & Farrer, 2009; de Graaf et al., 2009; Dennis & Chung-Lee, 2006; Gerhards et al., 2010; Merry et al., 2012; Pampallona et al., 2002). For example, in a study on the efficacy of group IPT carried out by Klier and colleagues, five of 22 eligible women chose not to participate and
attributed unwillingness to transportation or childcare difficulties (Klier et al., 2001). Despite the various intervention options and interactions with health professionals that deliver PND interventions, adherence to treatments in the postnatal period remains a problem, which needs to be investigated and addressed (Dennis, 2014).

To the best of our knowledge existing studies have not specially examined the factors that determine adherence to PND interventions. This review will identify factors that determine PND treatment adherence. These will be integrated into studies that will be used to establish requirements to help facilitate and change the PND treatment adherence behaviour. Furthermore, this knowledge will help to decide on the elements that are required for changing the adherence behaviour that should be considered for adjunct support for PND.

### 3.2. Methods

Studies were identified by searching electronic databases, which included: PubMed; IEEE; British Medical Journal; British Journal of Psychiatry; Journal of Clinical Psychology; Journal of Affective Disorder and Medline. These databases were used because of their relevance to the topic of PND and PND support interventions. Throughout this review, the terms intervention, treatment, and therapy are used interchangeably to mean pharmacological, psychological or multicomponent treatments for women with PND. For this research, the term compliance means adherence to treatment. Studies were included if they reported information related to intervention adherence; compliance; delivery and/or treatment preferences and if they focused on postnatal or postpartum depression. From the 1326 titles and abstracts identified, duplicate references were removed, and 805 non-relevant references were excluded. A total of 25 articles were judged potentially eligible for this review and reading. The study seeks to answer the research questions below:

- What are the factors that determine adherence to PND interventions?

### 3.2.1. Search methodology

The search keywords used included a combination of “postnatal depression”; “postpartum depression”; “intervention”; “adherence with treatment”, and “delivery of treatment”. The search result was restricted to full-text article in English published from 2000 to 2017.
Manually searching and reviewing references cited in retrieved articles supplemented the search.

![Search strategy flow diagram](image)

**Figure 3.1**: Search strategy flow diagram (Omisade et al, 2017, p. 3)

### 3.2.2. Study selection

Our study included measuring the methodological strength of each study based on a checklist developed by Mirza and Jenkins (2004) and used by Sawyer and colleagues.
Table 3.1 shows the methodological quality of the studies, with the following criteria, assessed:

1. explicit aims,
2. adequate and sample size justification,
3. the justification that sample is representative of the population,
4. clear inclusion and exclusion criteria,
5. valid measurement of postnatal depression,
6. response rate and drop out specified,
7. adequate description of data,
8. appropriate statistical analysis and
9. delivery of the intervention.

The studies were then given a total score with the highest possible being nine (1 = Yes, 0 = No). Table 3.2 displays the quality score for each study. Studies included in this review were of reasonable quality with over 80% of studies having a score of 7 or more. The types of intervention measured by studies included in this review were delivered by primary care practitioners (Milgrom et al., 2011); GPs (Milgrom et al., 2011); health visitors (HV) (Morrell et al., 2009); computer-based, telephone-based (Broom et al., 2015) and Internet-based interventions (O'Mahen et al., 2014).

### 3.2.3. Data extraction and synthesis

For each article, the intervention used varied between studies. For this review, treatments, and interventions have been grouped into pharmacological (PMI), which can include any antidepressants. Psychological interventions (PHI) include CBT; CCBT; PST and IPT. Multicomponent support interventions (MCP) includes peer support; exercise based; monitoring and assistance; educational programme and listening visit (Rojas et al., 2007) and finally usual/routine care (UC). The majority of the studies included in this review were randomized controlled trials (RCT), while the others were a cross-sectional survey (CSS). Five different measurement scale for depression were used, EPDS Edinburgh Postnatal Depression Scale (EPDS); Beck's Depression Inventory (BDI); Montgomery-Asberg Depression Rating Scale (MADRS); Hamilton Rating Scale for Depression (HRS-D) and Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSMI-IV). Adherence measures that were consistently used by majority of the studies where
employed. This is in line with Pampallona and colleague's (2002) approach. The measures of adherence were grouped into four categories:

a) Appointments kept (whether patients respected a pre-set schedule),
b) Pills monitoring (any measures of adherence based on direct count of pills actually taken),
c) Protocol deviation (termination of treatment before planned treatment period),
d) Composite index (a scale comprising of any measures of intake of drug and other indicators such as patient satisfaction, reasons for stopping treatment, knowledge about drugs, satisfaction with treatment).

3.3. Results

Twenty-five studies were included in the review with a total of 2438 participants. Sample size ranged from 15 to 595 (mean=116, Std = 132.6, mode=17). The majority of the studies were conducted in the United Kingdom (n=11) followed by Australia (n=4); United States (n= 3); Israel (n=1); Chile (n=1); Austria (n=1); Zimbabwe (n=1); France (n=1); Taiwan (n=1) and New Zealand (n=1). Four different approach of measuring depression was used by studies in this review: EPDS (n=15), DSM-IV (n=1), HDRS (n=1) and BDI (n=2). One study did not record the method used (n=1), another study assessed depression through a clinical interview (n= 1) while the remaining studies assessed participants using multiple approaches (n=6).

Ten studies were delivered at the Primary Care Centre (PCC) (n=10) and seven at the participant's home (PH) (n=7). Four studies were conducted at the PH and PCC (n= 4), and four studies did not record the intervention location (n= 4). Eighteen studies delivered the intervention face to face (FF) (n= 18), one study via the participant's telephone (PT) (n= 1), while three other studies used a combination of both FF and the PT (n= 3). One study provided the intervention through PT and email (n= 1), another study online (n=11) and lastly one study delivered the intervention by combining PT and online (n= 1).

For this paper, Health Practitioner (HP) includes therapist; psychiatrist; GP and clinicians. Ten of the studies delivered intervention with the help of HP (n=10), and five studies used Health Visitor (HV) (n=5). While three studies used a combination of HP and HV (n=3) another study used HV and email (n=1). In two studies interventions was administered via
text messages (n=2), two studies were Routine Care (RC) (n=2), one study was facilitated by the Primary Care Nurse (PCN) (n=1) and finally a combination of PCN and self-help (n=1).

Two studies measured adherence by using pills monitoring (n=2) while five studies utilised protocol deviation (n=5). Appointments kept were used in two studies (n=2), and five studies measured composite index (n=5). One study used a combination of protocol deviation and composite index (n=1), another study a combination of protocol deviation and pill monitoring (n=1). One study used a combination of protocol deviation, pill monitoring and appointment kept (n=1). However, eight studies were not explicit on how they measured women’s compliance to treatment (n=8) but provided clues on the association between the delivery of PND treatment and adherence.

Eighteen studies were randomised control trials (n=18), while eleven were cross-sectional studies (CSS) (n=11), and six studies used a combination of RCT and CSS (n=6). Four studies used MCP (n=4), two studies used PMI (n=2), and four studies used PHI (n=4). Some of these studies combined interventions, MCP and PMI (n=4); MCP and PHI (n=6); MCP, PHI and PMI (n=1); MCP and UC (n= 1); PHI and UC (n= 2). However, one study did not record the type of intervention used for their research protocol. All participants were women with postnatal depression. Table 2 gives an overview of the study described characteristics.
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3.4. Discussion

This review provides an overview of the current knowledge of the factors that are associated with adhering to PND interventions. This review includes studies from several countries published over a 17-year period. Despite methodological differences between the included studies (including differences in sample size; adherence measures; depression assessment measure and time points), there are several clues that suggest factors that might facilitate adherence to PND intervention.

The delivery of effective PND treatment is considered a priority, in this review some treatments are delivered face to face at PH or PCC (Chabrol et al., 2002; McCarthy & McMahon 2008; Morrell et al., 2009; Slade et al., 2010; Turner et al., 2010). This method of delivery is effective and provides better psychological adjustments, but it can be costly and time intensive for providers and women, reducing the capacity of reach of these treatments (Kaltenthaler et al., 2008; Gerhards et al., 2010; Stevenson et al., 2010; O’Mahen et al., 2015). This indicates that the delivery cost and times could potentially impact the delivery prescribed PND treatments and adherence. Two studies that delivered intervention with the help of HV suggested that good communication leads to a commitment to health provider’s advice and prescribed therapy and could result in greater adherence (Slade et al., 2010; Turner et al., 2010). Therefore, communication is crucial while delivering treatments.

Furthermore, studies that provided childcare during intervention process established an increased level of adherence (Honey et al., 2002; Reay, 2006; Rojas et al., 2007). Adequate provision for infant care during treatment could be an adherence factor. Also, three studies showed that adherence might be linked to the location in which the treatment is delivered (Prendergast & Austin, 2001; Chabrol et al., 2002; Reay et al., 2006). This is seen to have a relationship with stress management, and this might be due to transportation difficulties faced by some women (Goodman, 2009; Omisade et al., 2017). In regards to location, studies have documented the inability of women to attend regularly scheduled appointments (O’Mahen et al., 2015). Some studies demonstrated that delivery and adherence to intervention could be dependent on the duration of intervention process (Chabrol et al., 2002; Rigbi, Shalev-Mevorach, Taller, Taller, & Lerer, 2003; Roja, 2007; Turner et al., 2010). Two studies highlighted that women’s engagement with the intervention might improve adherence to treatment (Ho et al., 2009; Milgom et al., 2011). Four studies that provided a convenient intervention time showed that a flexible delivery choice and arrangement is associated with
increased adherence (Klier et al., 2001; O'Mahen et al., 2015; Reay et al., 2006; Slade et al., 2010).

The review indicated that the intervention delivery approach could impact adherence to prescribed PND treatment (Dennis, 2003; McCarthy & McMahon, 2008; Milgrom, Negri, Gemmill, McNeil, & Martin, 2005b; Reay, Fisher, Robertson, Adams, & Owen, 2006; Rojas et al., 2007; Scrandis, 2005; Shaw, Levitt, Wong, & Kaczorowski, 2006; Taggart, Short, & Barclay, 2000; Turner et al., 2010). Women with PND have found the presence of HV’s valuable. This might be because HV’s can empathise with women experiencing PND while delivering enhanced psychological care, with monitoring in place, upheld adherence and (Milgrom et al., 2011; Morrell et al., 2009; Murray et al., 2014). Moreover, women commented that having listening visits delivered by HV at home meant that they could talk in private with HV (Turner et al., 2010). However, these studies have not taken into account the limited availability of human resources (Sikander et al., 2015; Turner et al., 2010). Time commitments are required from both health workers and women who can be filled with demanding responsibilities. It is likely that some women will not receive regular support due to the HV’s absence (Morrell et al., 2009). Furthermore, practitioners providing visits need to have the time and skills to listen and provide tailored support (Turner et al., 2010).

An alternative to home-based HV delivered intervention is the provision of group treatment for PND. The group delivered intervention provides depressed women with the opportunity to share their experience of adjusting to motherhood or difficulties they go through with their peers and can help to reduce any feelings of solitude and loneliness (Klier et al., 2001; Reay et al., 2006). Socially isolated postnatal women particularly benefit from the support and empathy provided by the group, which can break patterns of social isolation and increase their recognition of the detrimental effect, which can result from self-stigmatisation (Klier et al., 2001). These studies give important clues on the direction of the association between delivery and adherence as they present evidence that suggests depressed women’s engagement with treatment could act as an important factor and thus might improve adherence (Ho et al., 2009; Lin et al., 2005; Milgrom et al., 2005a; Scholle & Kelleher, 2003).

Women are more likely to adhere to the treatment if they can engage with treatment facilitator and are extremely positive about their relationships with their health visitor or the delivery approach (Ho et al., 2009; Milgom et al., 2011). This is consistent with the study that revealed that it was only after women got into a supportive treatment relationship and improved their communication that they felt able to disclose their distress to others (McCarthy & McMahon,
2008). However, questions need to be asked on how to engage women if additional treatment options are made available.

This review has identified that interventions that are augmented by an adjunct support mechanism have the potential to improve adherence (Rojas et al., 2007; Milgrom et al., 2011). From the literature women receiving weekly phone calls, emails, and text message as additional support to treatment they received have found this helpful and reported high compliance rate (Cooper et al., 2003; Coates et al., 2004; Cuijper, Brannmark & van Straten, 2008; Turner et al., 2010; O’Mahen et al., 2014; Broom et al., 2015). Similarly, there was a record of increased adherence in a multicomponent intervention that was supported by regular phone calls from trained mental health workers. In this study, depressed women were always reminded about the need for taking medications as prescribed in treatment sessions (Rojas et al., 2007). However, lack of consultation time is highlighted as unsatisfactory and women would prefer better follow-up care from health professionals (Boath et al., 2004). It is advised that adjunct treatment needs to remain available to women receiving visits both during and after the visit has ended (Turner et al. 2010). This might be a solution to the disappearance of improvement recorded at 3-4.5 months at 6-12 month in a study on the short- and long-term effect of psychological treatment of PND as well as improve adherence (Copper et al., 2003; Roja et al., 2007).

Women are faced with the problems of managing their infant’s needs while balancing other valued tasks (O’Mahen et al., 2014). There is evidence that adequate provision for infant care plays a vital role in the association between intervention delivery and adherence to the treatment plan (Reay et al., 2006). Studies that provided facilities for infant care during treatment trials reported a higher level of compliance to treatment than those without (Honey et al. 2002; Reay, 2006; Rojas et al., 2007). However, additional empirical evidence is warranted, specifically prospective studies should take into account both the cost of delivery and childcare.

A flexible delivery choice and arrangement have been associated with increased adherence (Klier et al., 2001; O’Mahen et al., 2014; Reay et al., 2006; Slade et al., 2010). Some women discounted the treatment because they did not have enough time, women who were working or studying completed fewer treatment modules while being on maternity leave or not working were related to completing more modules (O’Mahen et al., 2014). In a study that demonstrated increased adherence, of the 17 eligible participants, 15 were on maternity leave (commonly up to 2 years in Australia), one was unemployed, and 1 was a housewife (Klier et al., 2001).
This showed that women the women on maternity were able to attend due to the reduced work commitments. Another study showed that treatment took place during school term to attract mothers with additional school-age children and minimise dropout (Reay et al., 2006). Therefore a flexible delivery choice may contribute to quality delivery and increased adherence.

In a study, women commented that they knew they only had one hour to talk to their HV (Ho et al., 2009). Depressed women’s knowledge of the duration of intervention is a strong predictor of adherence (Chabrol, 2002; Ho et al., 2009; Rigbi et al., 2003; Roja, 2007; Turner et al., 2010). However, there is limited empirical evidence to make a generalised conclusion.

In general, given the identified intervention adherence factors, it is increasingly seen as important to establish these factors in more studies. It is also essential to have in place adjunct intervention support that will help women comply with treatment and help sustain treatment effect over the long-term (Copper et al., 2003; Roja et al., 2007). The United Kingdom National Health Service (NHS) suggests that better use of data and technology has the power to improve health, transforming the quality and reducing the cost of health and social care services. It can give patients and citizens more control over their health and wellbeing, empower carers, reduce the administrative burden for care professionals, and support the development of new medicines and treatments (Personalised Health and Care 2020, 2014). Given these promising findings, there is a need to develop and evaluate methods of promoting adherence and sustained treatment outcome in the PND population.

### 3.4.1. Mobile application as an adjunct support to Postnatal Depression intervention

With the rapid evolution of technology, the computing capacity of mobile technologies has advanced to the point that today's mobile devices function like handheld computers and are highly integrated into our daily lives (Payne et al., 2015). Mobile Health (mHealth) solutions to assist treatment management and to enhance adherence are gaining interest, with some promising results in different chronic diseases, including some mental health diseases (Desteghe et al., 2017; Michelle, Jarzabek, & Wadhwa, 2014). The increase in the use of mobile phones and mobile applications may offer additional opportunities to provide support and may circumvent many of the difficulties that lead to poor adherence in PND (Michelle et al., 2014). Recent researchers have reported on the feasibility and efficacy of phone applications in intervention through behavioural change (Adamakis, 2017).
A new app (Health Buddies) was developed as a tool to improve adherence to non-vitamin K antagonist oral anticoagulants in an elderly Atrial fibrillation population by providing a virtual contract with their grandchildren, spelling out daily challenges for both (Desteghe et al., 2017). Another study examined a theoretically based intervention for female college students with problem drinking that combines brief, in-person counselling with ecological momentary intervention on a mobile app integrated with a wearable sensorband (Leonard et al, 2017). A study used patient-centered research methods to inform and improve the design and functionality of our type 1 diabetes app, MyT1DHero, and to provide insight for others who are designing a health app for adolescents and parents (Holz et al., 2017).

Importantly, a mobile application might provide, guided support, confidentiality for users’ engagement, which may further encourage personalised interaction in a more practical and non-intrusive fashion as well as specific treatment adaptation (O’Mahen et al., 2014; Wilson, Rickwood, Bushnell, Caputi, & Thomas, 2011). It could offer the opportunity to provide just-in-time support and resources to those that have particular needs for flexibility (Kaltenthaler et al., 2008). Although there are limited studies addressing the benefits of mobile technology to support PND, with the advantage of continuous and ubiquitous access, mobile applications have the potential to decrease barriers for help seeking and make therapeutic activities more accessible and less stigmatic (Matthews, Doherty, Coyle & Sharry, 2008; Huang & Bashi, 2017). While mobile application could potentially be a useful tool to enhance adherence to treatment (Cuijpers, Donker, van Straten, Li & Andersson, 2010; O’Mahen et al., 2014), specific data that informs adherence-improving intervention for PND are very scarce. This research investigates factors that determine positive intentions to adhere to PND treatment, which could inform the development of an adjunct mobile application.

3.5. Limitations of this review

The studies included in this review used a range of measures and at different time points after childbirth and this makes it difficult to explain how PND progresses over time. It is a very difficult to distinguish those with first-time mental illness or previous history of mental health (Kessler, 2003). The majority of the studies used EPDS to identify depression; however, the cut-off points varied, leading to different estimation of the prevalence rate. The significant variance between study samples has implications for generalisability and interpretation of research findings. With regards to the measures of adherence, some studies used multiple measures and at different time points during the study. For example, in one study the administering of antidepressant was irregular based on participant’s improvement, and
compliance was assessed by a pill count conducted at each follow-up. One cannot exclude the possibility that the women manipulated themselves to appear compliant. Furthermore, some studies combined protocol deviation and appointment kept to assess adherence, this makes difficult to generalise on the factors that motivate women, the impact of the adherence and if women were able to sustain it in the long-term, hence further studies are required. It is also important to note that there is a possibility that some of the women who completed the study might have been provided with additional support (such as support / treatments reminder from family) that can facilitate compliance with treatment.

While there are good theoretical justifications for many of the intervention delivery approaches, their efficacy has not been established, and there is very little good evidence available on which to base policy or practice recommendations (Boath & Henshaw, 2001). It is also not clear whether the delivery approach helped depressed mothers and her infant live their lives better or if the intervention had an effect on mothers experience immediately after treatment. There is also insufficient evidence to conclude on whether a depressed mother's preference of delivery approach can improve adherence. Also, research has not shown the procedures about the consistency of support especially in the case of absent healthcare workers.

This review highlights various omissions in published literature. For example, research on factors that determine women’s engagement with treatment after childbirth is limited. This is an important gap to be addressed, particularly as effective engagement can enhance treatment adherence (de Graaf et al., 2009). Likewise, no studies are using adjunct support such as mobile application, which provides additional follow-up resulting in difficulty concluding its impact on PND treatment delivery and adherence. Therefore, additional studies are required to establish the benefits of additional support in improving adherence to PND treatments.

### 3.6. Conclusion

This chapter examined the factors associated with adhering to PND interventions. The findings and recommendations from this review establish the aim and objectives of this research project as indicated in chapter 1. The findings above suggest that non-adherence to treatment is a major problem faced by healthcare professionals and can increase the cost of healthcare service, both in financial terms and time investment (Pampallona et al., 2002). A lack of adherence to treatment by women with PND has been shown to increase the length of time spent in treatment for psychological disorders, as well as to decrease the long-term effect of
the treatment outcome (Dunn, 2002; Cooper et al., 2003; Rigbi et al., 2003). This review identified that adherence factors such as provision for infant care; availability of adjunct support to treatment; treatment duration; cost; location; delivery approach and women’s engagement with intervention. However, we cannot establish whether these factors can facilitate and change adherence behaviour. For example, it is difficult to conclude whether adherence was due to the home-based intervention, the phone call or a combination of both. A comprehensive study of this subject is needed to adequately ascertain which factors motivate women and identify obstacles that contribute to non-adherence. Furthermore, offering additional support may circumvent many of the barriers to treatment, adherence and motivate women to manage their wellbeing. The availability of additional support for effective PND interventions might help provide the support needed to adhere to treatment and promote just-in-time intervention delivery, adherence and support for coping with the demands associated with childcare.

Mobile Health is growing as a method to improve adherence and health outcomes. An adjunct mobile application is one method that may hold the promise of doing such. Developing a suitable and appropriate mobile application is desirable, given its potential to increase adherence to the behaviour being promoted (Desteghe et al., 2017). This tool could support individuals with treatment/work already offered by practitioners, thus allowing sessions to be offered at a reduced frequency, duration and a cheaper cost and convenient location. There is a need to establish the suitability and appropriateness of a mobile application. The mobile application should be evaluated for suitability and appropriateness to enhance the likelihood that the tool can effectively change behaviour. Further research is also needed to determine the acceptance of such a mobile application by both women with PND and practitioners. Such research should allow us to establish the requirements under which a mobile application for PND may be offered as effective and accessible support. Therefore, several findings from this literature are explored in chapter five and six of the thesis.
4. Research methodology and design

4.1. Introduction

This chapter presents the overall methodology used in this research project. This will include a brief discussion on the goal of the study, followed by the theoretical foundation, which guided the study, the research philosophy, pragmatic mixed method, data management, and finally the ethics. Figure 4.1 demonstrates the stages and steps, which are involved in this research project. This research is in three stages; the first stage investigated and developed the PND treatment adherence framework, the second stage focused on the development of the mobile application and the final stage was the evaluation of the application.

4.2. Research Goal

As discussed in section 1.4, this research aims to contribute to the development an intervention that will help women with PND in changing and facilitating treatment adherence behaviour. To achieve the aim of this research, in-depth consideration of the important factors for adherence to PND treatment is essential to provide improved adherence intervention. This will also include a better strategy to minimise the barriers to the successful development of PND adherence interventions. Therefore, for women with PND, this would require a change in behaviour. Modifying people’s behaviour toward intervention is at the core of many efforts to improve the human condition, commitments and long-term maintenance of behaviour change (Ajzen, 2011). Research suggests that novel methods are needed to ensure long-term maintenance of behaviour change (Du et al., 2016).

Behaviour change is key to improving healthcare and health outcome. Behaviour may be those of patients, such as treatment adherence, health workers, such as the implementation of evidence-based practice, or of the general population (Cane, O'Connor & Michie, 2012). Changing behaviour is not easy, but is more efficient if intervention is based on evidence-based principles of behaviour change (Abraham, Kelly, West & Michie, 2009). There is evidence that behaviour change interventions informed by the theory are more effective than those that are not (Albarracin et al., 2001; Cane et al., 2012; Noar & Zimmerman, 2005).

Researchers have long recognised the importance of theoretical models as a foundation when conducting a research project (Rossi, Lipsey & Freeman, 2004; Ajzen, 2011). Using frameworks, models and theories to design interventions allow for description,
characterisation and contextualization of many potential factors towards increasing success of changing behaviour and ideally, allowing for possible replication of interventions with adaptable implementation strategies (Murphy et al., 2014). Theory-based interventions can explain attitude towards intervention, developing an understanding of the causal processes and mechanism which accounts for observed behaviour change (Godin et al., 1992).

As the research program described here is concerned with designing an intervention to change and facilitate adherence behaviour, a behavioural change oriented theory was therefore adopted. For optimum effectiveness, the use of a theory that resonated with the purpose of research informed the study. The Theory of Planned Behaviour (TPB) was chosen for this study because it seemed more appropriate for situations where women do not perceive themselves as having complete control over their behaviour (Ko et al., 2004).

![Diagram demonstrating the steps within the research methodology](image)

**Figure 4.1**: Diagram demonstrating the steps within the research methodology

### 4.3. Self Determination Theory

Research described the process of health behaviour change as entailing the dual tasks of initiating and maintaining change (Rothman, 2000). Although there are many approaches to initiating change, from external pressure and control to the positive use of incentives or
rewards, the ingredients essential to maintenance are often missing. Self Determination Theory (SDT), in contrast, is particularly focused on the processes through which a person acquires the motivation for initiating new health-related behaviours and maintaining them over time (Ryan, Patrick, Deci & Williams, 2008). SDT argues that developing a sense of autonomy and competence are critical to the processes of internalization and integration, through which a person comes to self-regulate and sustain behaviours conducive to health and well-being (Ryan, et al., 2008). Thus, treatment environments that afford autonomy and support confidence are likely to enhance adherence and health outcomes. Equally important to internalization in the SDT view is a sense of relatedness. People are more likely to adopt values and behaviours promoted by those to whom they feel connected and in whom they trust. However, in this case we assume that women with PND have limited capacity due to their mental state.

4.4. Theory of Planned Behaviour

Ajzen (1988, 1991) proposed the TPB (Figure 4.2) as a potentially useful framework for the design and evaluation of behavioural change interventions. The TPB is a well-validated behavioural model that has been applied to health care interventions and other contexts (Hardeman et al., 2002; White et al., 2015).

TPB is one of the leading behavioural models explaining motivational influences on behaviour. It provides a useful prototype to investigate intentions and to predict determinant factors and behaviour towards intervention adherence. It is a theory that postulates a clear interrelated set of variable formed into propositions, or hypothesis that specifies the relationship among variables (Creswell, 2003). The TPB is commonly used by health psychologist to determine how likely a person is to engage in particular behaviour (Godin, Conner, & Sheeran, 2005). If an individual has limited control of a given behaviour, the investigator should examine not only attitude or intention but also the perceived control of the individual over this behaviour (Godin et al., 1996; Ajzen, 2011).
Explaining TPB, behavioural intention and actual behaviour is influenced by three factors: a favourable or unfavourable evaluation of the behaviour (behaviour belief and attitude); perceived social pressure to perform or not perform the behaviour (subjective norm); perceived capability to perform the behaviour (self-efficacy), or perceived behavioural control (Ajzen, 1991). Perceived behavioural control can influence intention, as well as attitude and subjective norms. It can also predict behaviour directly, in parallel with the potential influence of intention, in situations where behaviour is not under total control of the individual (Godin et al., 1992). In combination, they lead to the formation of a behavioural intention. Intention represents the motivational antecedent of behaviour and indicates how much effort a person is likely to devote to performing a behaviour. In the context of this research, this is of particular importance to women with PND as there is often an emphasis on treatment adherence effort and the sustaining the impact of intervention over the long-term (see Fig 4.3).
4.5. Investigation and development of the Postnatal Depression treatment adherence framework

In order to rigorously approach this research, the construct of TPB guided the investigation and development of the PND treatment adherence framework. According to the TPB, the three constructs are all conceptualised as determinants of both intentions towards behaviour and the actual behaviour. Each of these constructs informed steps two, three and four in stage one and step eleven in stage three of this research project (see Fig. 4.1).

The second step in the first stage of this research was the identification of behavioural and control beliefs. This included an investigation into factors that determine intentions to adhere to PND treatment. The views of women with previous episode of PND, who have the first-hand experience of using intervention and managing their overwhelming responsibilities are rarely sought. Most treatment adherence interventions often limit the inclusion criteria to only women with a current episode of PND. Where women are expected to manage the use of intervention on their own, issues of fitting the use of prescribed treatment into their everyday life becomes critical.

Furthermore, people often act according to their perception of what others (e.g., practitioner, family, friends) think that they should do. Therefore, their intention to perform a behaviour is potentially affected by people with whom they have close relationships. In this context, we assume that the practitioners are significant and have great influence on women’s decision to adherence to treatments. This research takes into account that the opinion of specialists who provide support to depressed postnatal women.

Throughout the first stage of the study, women with previous episodes of PND and practitioner participated in the investigation. This enquiry was guided by identifying the behavioural beliefs, subjective norms and control beliefs. This covered steps two, three and four of the framework (step one was described in chapter two and three). The results of step one, two, three and four were built on to create beliefs and attitudes towards PND interventions that could potentially benefit practitioners who intend to change or motivate the adherence behaviour. It also helped to decide on the factors that should be supported or discouraged by an adjunct mobile application for PND. Furthermore, this allowed the development of the PND Adherence Behavioural Change Framework and informed the requirements that were used in specifying the design of a theory-based adjunct mobile application to support treatment adherence in PND.
4.6. Design and development of the mobile application

Moving to the development stage, we have applied the scenario-based design technique to build on the requirements proposed. This lead to the development of an adjunct mobile application for PND. A scenario-based method is a well-established tool in user-centred design, embodying user requirements and early design concepts (Carroll, 2000). This stage of the project, includes detailed design requirements and justifying design decisions and implementation of the proposed system.
4.7. Mobile application evaluation

In step eleven we focus on the evaluation of the adherence tool. The evaluation was guided by the TPB. The evaluation involved the normative belief (subjective norm), perception about the expectation of significant others. People often act according to their perception of what others (e.g., practitioner, family, friends) think that they should do. Therefore, their intention to perform a behaviour is potentially affected by people with whom they have close relationships. In this context, we assume that the practitioners are significant and have great influence on women’s decision to use a mobile application as a tool to facilitate increased adherence in PND. Therefore, practitioners evaluated whether the proposed mobile application is a tool that could potentially help women with postnatal women have control over their adherence behaviour. We also examined whether it could also serve as a tool to motivate the adherence behaviour, as well as help to facilitate sustained treatment outcome. Based on the TPB, the more favourable the professional’s opinion is, the more likely women will intend to use the mobile application as an adherence tool. This stage maintained using user-centred agile methodologies, however, in this research project, only one iteration was carried out.

4.8. Research philosophy

Research philosophy is a set of beliefs, assumptions and practices that guide a field (Johnson and Onwuegbuzie, 2004). A researcher’s philosophy would depend on how one thinks about the development of knowledge, and it will influence the way research is conducted (Saunders et al., 2003). Furthermore, the choice of approach will also influence the status and nature of data which has implications for the standing of any research findings (Zachariadis, Scott & Barrett, 2010). Researchers studying information systems bring with them not only a range of methods and methodologies but also a diversity of underlying philosophical assumptions about research and, going deeper, regarding understanding and cognition of reality and truth (Recker et al., 2006). However, no one research approach is better than another, and the choice of the appropriate approach much depends on the research question (Saunders et al., 2003).

We begin by investigating the research design that is employed in this research. Participant confidentiality is, of course, important to a study where perceived stigma is a major problem, the sensitive nature of the information and collecting rich and saturated data could be a crucial success factor. The research philosophies utilised within this research will be discussed, with an overview on positivism that may be more likely to provide confidentiality and anonymity and
interpretivism that can establish a level of rapport that is crucial for collecting rich and personal accounts followed by pragmatism that is a combination of positivism and interpretivism.

4.8.1. **Positivism and Interpretivism**

Positivism (quantitative) leans towards facts and studies the relationship of one set of facts to another (Bell, 2010). Positivism involves the identification of the collective strength of multiple variables, conceptual framework, and design (Bell, 2010). The emphasis is on quantifiable results that lend themselves to statistical analysis. The advantage of a positivistic approach includes valid operationalisation and measurement of a particular construct; the capacity to conduct group comparison and examine the strength of association between variables of interest; the capacity for model specification and testing of the research hypothesis. However, one major limitation of the positivistic approach is that measurements typically detaches information from its original ecological “real world” context (Moghaddam, Walker & Harre, 2003; Castro et al., 2010).

Interpretivism approach (qualitative) allows researchers to develop a deeper understanding of the data (Houghton et al., 2012). Interpretivism approach alone may not be sufficient to answer research questions because they often lack well-defined prescriptive procedure. This limits the capacity to draw a definitive conclusion, an important aspect of scientific research. Also, purely interpretative studies have been challenged for focusing on depth of analysis in small or unrepresentative samples and thus their limited capacity to produce generalisable findings (Castro et al., 2010).

4.8.2. **Pragmatism**

Pragmatism takes an explicitly value-oriented approach to research (Johnson and Onwuegbuzie, 2004). When the pragmatic philosophy is applied to research, claims on knowledge are assessed regarding actions, situations and consequences (Creswell, 2003). The pragmatic approach opens the door to multiple methods, different views, different assumptions, as well as to various forms of data collection and analysis (Creswell, 2003). The pragmatic approach focuses on the problem, and researchers use various approaches to understand the problem (Creswell, 2003).

Pragmatic philosophy attempts to fit together the insights provided by qualitative and quantitative research into a workable solution (Johnson and Onwuegbuzie, 2004). It
emphasizes shared meaning and joint action (Morgan, 2014). Like other successful research, pragmatism offers an increasingly popular approach to the philosophical challenges of mixed methods research (Tashakkori & Teddlie, 2009; Morgan, 2014). Pragmatism acknowledges the epistemological differences between qualitative and quantitative approaches but does not see these forms of inquiry as incommensurable and advocate a shared aim for all research (Bishop, 2015). Combining the qualitative and quantitative approaches in this research helped to address key philosophical concerns that often deter the more extensive use of multiple methods, encourage openness to innovative methodological choices, and deepen practical understanding about how critical pragmatism can be utilised as the foundation of IS research projects (Zachariadis et al., 2010). Furthermore, pragmatism also helps to shed light on how the research approaches can be mixed fruitfully (Hoshmand, 2003). The use of a pragmatic approach helped the researcher to find the most appropriate solutions to the research questions. This is because it allows openness to the objective and subjective knowledge of participants which is appropriate for this research and aligns with the research aims.

In this research project, the researcher is concerned with “what works”, the solution to the problem and therefore used the pragmatic approach to understand the problem. Using the pragmatic method allowed the researcher to embrace different ideas, explanations and quality understanding of the research problem (Creswell, 2003). Thus, the biases inherent in one approach (positivist approach) is neutralized by the biases of the other (interpretive approach).

Creswell (2003) emphasise that it is essential for mixed method researcher employing a pragmatic approach to establish a rationale for the reason why quantitative and quantitative data need to be mixed in the first place (Creswell, 2003). This research project takes a pragmatic stance and adopted a mixed method that helped answer different aspect of the question about PND interventions, adherence and the use of adjunct mobile applications as support for PND. The positivist approach was necessary to facilitate a cautious design and to avoid triggering distressing moments. To allow the development of rapport that might, in turn, facilitate a more in-depth account of professionals’ perspective of PND intervention the interpretive approach was necessary. Using a pragmatic stance to mixed methods also helped to retain the integrity of individual quantitative or qualitative components to maximise their contribution to the overall research goals (Morse, 2003; Yardley & Bishop, 2008).

Furthermore, Yoshikawa, Weisner, Kalil and Way (2008) noted that examining behaviour and beliefs require both quantitative and qualitative approaches to research Studies using the TPB research supports the decision to use quantitative or qualitative approaches when applying
the theory to behavioural change (Ajzen, 2006). Dubay et al., (2015) utilised a concurrent mixed methods design guided by the TPB to analyse African American’s decisions to become a registered organ donor using both qualitative (focus groups) and quantitative (survey) methods. Similarly, an explanatory mixed method study design, based on health behaviour change theories was used to explore physical activity behaviour among 18–25-year-olds with influential factors including attitudes, motivators and barriers (Poobalan, Aucott, Clarke, & Smith, 2012). As described in 4.3 behavioural intention is a consideration of the TPB constructs behavioural beliefs, the normative expectation of other and control beliefs. This mix of TPB constructs is well suited to a combination of quantitative and qualitative methods. This is evident in a study that assumed that quantitative approach is necessary for the monitoring of sleeping parents’ and infants’ physiological and behavioural patterns. But to understand the meaning, practices and context of sleep patterns between mothers and children the quantitative and qualitative approach are necessary (Yoshikawa, et al., 2008).

4.9. Deductive approach

The deductive approach involves the development of a theory, and it is mostly used in natural science research (Saunders et al., 2003). Deductive reasoning works from the more general to the more specific. Sometimes this is informally called a "top-down" approach. Robson (2002, p19) proposes five sequential stages for deductive research that was adopted in this research project:

- Deducing a hypothesis from the theory
- Proposing a relationship between specific variables in a hypothesis
- Testing the hypothesis
- Examining the specific results of the inquiry
- Modifying the theory in the final finding (if necessary)

The deductive approach was employed in step two, three, four and eleven of this research study. Several research questions were asked and that lead to data collection, finding to rejection or confirmation of the research question.
4.10. Inductive approach

Inductive research is an alternative approach, and it has the strength to develop understanding. Inductive reasoning works the other way, moving from specific observations to broader generalisations and theories. In this research project, we begin with:

- Specific observations and measures
- Begin to detect patterns and regularities,
- Formulate some tentative hypotheses that we can explore, and finally end up
- Developing some general conclusions or theories.

Figure 4.4: Research approach adopted in the research study
4.11. Research Design

The research design is a general plan for how to answer the research question. The following section will discuss the design, together with an overview of the methods which will be employed in this research study. Figure 4.5 shows the research design employed in this study.

4.11.1. Mixed methods

In mixed methods research, qualitative and quantitative approaches are utilised together in a single study or series of related research (Bishop, 2015). The combination of “elements of qualitative and quantitative research methods for the broad purpose of breadth and depth understanding and corroboration” (Wilkins & Woodgate, 2008; Johnson, Onwuegbuzie, & Turner, 2007) can be described as mixed method research. Mixed method research aims to incorporate the strengths of both qualitative and quantitative approaches for conducting rigorous research that meets the scientific standard of reliable philosophical assumptions and technical methods of inquiry (Castro et al., 2010).

Mixed method research allowed the researchers to build a comprehensive picture: where using a combination of quantitative and qualitative methods can allow a phenomenon to be described and explained broadly and comprehensively (Glogowaska, 2011). In this context, the quantitative and qualitative methods provides complementary insights that together provided a more comprehensive understanding of the use of an adjunct mobile application for PND than would have been achieved by either component alone. This research adopted a mixed method philosophical approach following a pragmatic approach. Mixed method is believed to be rooted in pragmatism (Johnson & Onwuegbuzie, 2004; Denscombe, 2007).

As previously discussed, this research project was split into three stages, each with their aims and objectives. This research also pursued the concept of ‘complementarity’. The first and the second study was a mixed method study that collected qualitative and quantitative data concurrently. Study one approached the research from a positivist perspective. Quantitative data were used to assess the view of women with previous episodes on PND on interventions and to use as mobile applications as adjunct support for PND. We used an online questionnaire with open and closed-ended questions to collect data from participants. The quantitative component explored their experience of PND interventions, adherence to treatment and the acceptance of adjunct mobile application.
In the second study, we conducted a qualitative analysis of semi-structured interviews with professionals in the field that explored their experience of PND interventions and using adjunct mobile application for PND in depth. Interviews were conducted to collect data from professionals who have experience providing support for women with PND. Thematic analysis (Joffe & Yardley, 2004) resulted in the identification of themes. The qualitative and quantitative components provided complementary insights that together provided a more comprehensive understanding of interventions, adherence and adjunct mobile application that would have been achieved by either component alone.

The third study builds on the knowledge gained from the first two studies, and this informed the development of the mobile application that was evaluated by professional in a quantitative study. This is discussed in chapter ten of this thesis. This study was designed as a sequential exploratory study (Creswell & Plano, 2007) because we aimed to use the mixed method to explore women and professional view on PND intervention and adjunct mobile application. The secondary goal was to extend this work by developing an adjunct mobile application and to test it quantitatively. The next section discusses the methods used in the studies.
4.11.2. Data collection method

The selection of a data collection method is based on what kind of information is sought, from who and under what circumstances (Robson & McCartan, 2016). Questionnaire and interviews are widely used methods of collecting data in mixed method research (Brace, Kemp & Snelgar, 2012). Each of these methods can result in the collection of quantitative or qualitative data.

4.11.3. Questionnaires

In study one, a questionnaire was used explore women’s experience of PND intervention and obstacles to non-adherence. This method was used in Hales, Evenson, Wen & Wilcox’s study (2010), that developed and examined the evidence for factor validity and longitudinal invariance of the scale used to measure TPB constructs applied to physical activities. Previous
research on PND using interviews, participants appear to have found it difficult to talk openly about their experience and this limited the scope of previous findings (Ruaro, 2013). Self-stigma may serve a barrier and participants may refuse to share their experiences of PND (Jones et al., 2013). However, there is an indication that women are willing to share their experiences anonymously and what is perhaps considered a more secure context (Cacciola, 2014). Hence, a strategy of inquiry in which anonymity of study participants is maintained to enhance participation rate and also to ensure confidentiality was required for the study. Therefore, we adopted the use of an online questionnaire. An online questionnaire has an ethical advantage because they do not expose individuals and are quite flexible to fit into the busy schedules of participants (Robin & McCartan, 2016). Furthermore, the online data collection promises increased sample size, greater sample diversity, easier access and convenience, lower cost and time investment (Robin & McCartan, 2016).

This method was also adopted sequentially in the third study. Due to the limited response to the second study and busy schedule of practitioners, it was assumed that the use of an online was appropriate for the study. Participants who are practitioners were asked to interact and engage with the mobile application for at least one week and subsequently presented with the questionnaire. The third study was to test whether the mobile application will help increase adherence, sustain treatment effect and wellbeing. We also evaluated the completeness and relevance as well as the extent to which mobile application functions properly. Therefore, we assumed that the use of questionnaires was appropriate for the study and aligns with the aims of the research.

4.11.4. Interviews

Study two was a qualitative study that aimed to explore professionals’ experience of supporting women suffering from PND to identify their views on PND intervention an adjunct mobile application and obstacles to non-adherence. Using qualitative data, White et al., (2015) found several views underpinning hospital-based registered nurses decision to perform hand hygiene. There are different methods of qualitative inquiry, grouped into the four main categories of Grounded Theory, Disclosure Analysis, Narrative Analysis and Phenomenology. Each focuses on a different aspect of the data and has different goals (Smith, Flowers & Larking, 2009).

Grounded Theory is a cyclical qualitative inquiry method that does not start with a hypothesis, nor do they begin their investigation with a thorough review of the literature. They build theory
from their data and tend to lean more towards realism (Bell, 2010). Although Grounded Theory could be useful for the research, however, we do not have the requirements for an iterative method of inquiry. Discourse Analysis is the analysis of patterns such as the different patterns that people’s utterances follow when they take part in various domains of social life (Jorgensen and Phillips, 2002). Discourse Analysis emphasises how societal ideas define individual psychology. Social interaction heavily influences women’s mental health (Bina, 2008) but this study views them as one of the several components affecting individual psychology. The narrative analysis involves the collection and development of stories, either as a form of a data collection or as a means of structuring research (Kuhnlein, 1999), however, this research preferred a methodology that is more open to the emergence of the different aspects of the participant experience. Interpretative Phenomenological Analysis (IPA) is a qualitative research method committed to the examination of how people make sense of their experiences.

IPA was adopted in this study because it offers an opportunity to develop an idiographic understanding of participants view. IPA is a qualitative research methodology that aims to explore in detail how participants are making sense of their world (Smith and Osborn, 2007). IPA is committed to detail and depth analysis of a small, purposely selected and carefully-situated sample rather than focusing on general laws of behaviour or investigating group behaviour. As the one of the objectives of this study was to explore professionals’ individual experiences of treating PND, activities and content of therapies specific to support postnatal depression. It was important to use a methodology that could capture and validate the uniqueness of each participant’s experience of helping women with PND.

Participants in this phase are professionals who provide support for women with PND via the social media, parenting support and fertility forums. NICE guidelines for antenatal and postnatal mental health suggests that the health practitioner should continue to have a significant role in the detection and management of PND (Chew-Graham, 2008). IPA views human beings as meaning-making creatures. Therefore, the participant's account is seen to reflect their attempts to make sense of their lived experience. Participants in this study are people who have of their volition made themselves available for advice and because they have long experience of using therapies and techniques as part of their providing support for PND. It was mentioned that anonymity and confidentiality were promised to all participants. Participants were selected purposely rather than randomly due to the limited access to the potential participants.
4.12. Ethical consideration

All studies carried out in this research were conducted after undergoing positive ethical review from the ethical committee of the Faculty of Technology University of Portsmouth. Research involving human participants today is subject to ethical considerations (Kimmel, 2007). Ethics can be defined as the science of morals or rules of behaviour (BPS, 2009). This study was also followed the Code of Ethics and Conduct set out by the British Psychological Society (2014). This code requires that researchers carrying out research adhere to four main principles: respect for the autonomy and dignity of persons, competence, social responsibility and integrity. It is beyond the scope of this research, so we have not considered these factors in great detail.

In the first study conducted in this research, we recognised that participants may find some of the questions trigger distressing memories. Therefore, we designed the questionnaire to ensure that questions relate more to the type of therapy used and its effectiveness, as opposed to relaying past experiences of PND specifically. We also provided a set of resources that could support women, in the event they became distressed. We did not ask any questions relating to children being at risk, or other likely distressing memories. Participants were provided with sufficient details of the study at an appropriate level of understanding and had the right to withdraw at any time while completing the questionnaire.

For the second and third study, the researchers did not foresee any ethical issues in conducting the study with professionals; however, participants were informed of the aims and objectives of the study and provided with feedback when required. Participants were provided with sufficient details of the study. They had the right to withdraw at any time during the interview. We considered the research data management and respect for dignity, autonomy and integrity throughout the research and this will be discussed below. It is important to note that ethics process for the Faculty of Technology University of Portsmouth took longer than expected for all the studies. The process included several iterations, this slowed down the research process and extended the length of our research.

4.12.1. Research data management

The researcher is aware of the need for confidentiality and adheres to the policy outlined by the University on data management. Researcher ensured that 'active' research data is stored securely and protected from loss, unlawful or unethical access, and in accordance with all
other applicable requirements of the regulatory environment. Data and responses collected from this research are encrypted on a USB drive, and this is stored in a filing cabinet in a locked office within the School of Computing University of Portsmouth. Data was accessed only via a password-protected computer, and only the named researcher had access. Electronic files were deleted from computer hard-drives and servers when no longer required. All data will be held securely for a minimum of 4 years following the publication of reports or articles resulting from data generation and then safely destroyed. The exception to this will be the University, who to the best of our knowledge does not provide a policy on data destruction. We aim to destroy data permanently and irreversibly.

4.12.2. Respect for dignity, autonomy and integrity

Throughout this study, the researcher identified that respecting the dignity and autonomy of contributors and other persons is essential. The points considered are as follows:

- being open in dealings with contributors
- working on the basis of valid consent from contributors
- promoting fairness and sensitivity in portraying individuals and groups
- advocating reasonable rights of reply
- observing best practice standards for privacy, confidentiality and anonymity which are only infringed with the valid consent of the person(s) concerned or where there is an apparent over-riding public interest
- refraining from public comment on the behaviour or psychology of identifiable individuals where there is any risk of offence, distress or other harms
- considering potential effects on third parties such as relatives and colleagues of contributors
- advocating caution in the use of archive or library material involving emotional trauma, illness, death or suffering, or revelations of a personal nature, and in the need for appropriate consent for the re-use of such material or material supplied by third parties
- advocating for the protection of the rights of persons who are vulnerable or of limited capacity (Code of Ethics and Conduct, 2009)

Furthermore, for this research project, it was considered essential to support high standards of integrity when conducting research, and the following guidelines were applied:

- maintaining high scientific standards of accuracy and evidence
• advocating respect for academic freedom and integrity
• advocating coverage of a diverse range of views and fostering debate
• advocating for engagement with appropriate ethics review
• avoiding offering comment, opinion or advice beyond one’s professional competence
• maintaining high standards of professional practice and ensuring appropriate supervision and support from professional peers
• respecting the duty of confidentiality to one’s clients
• ensuring that one’s correct professional title is referenced in the production or the credits, as appropriate
• being socially responsible
• recognising that media production exists within the context of human society and has a potential for great influence
• accordingly, acknowledging a shared collective duty for the welfare of human and non-human beings, both within the societies in which media production takes place and beyond them.
5. Women’s perception of factors affecting Postnatal Depression interventions adherence

5.1. Introduction

The overall aim of this research project is to develop an intervention that will help women with PND in changing and facilitating their treatment adherence behaviour. As stated in chapter three and four, there is need to understand women’s beliefs and attitudes towards PND interventions, control beliefs and how they form their intentions to engage, perform or not perform the adherence behaviour. Taking a user-centred design approach, the study described in this chapter aims to identify women’s adherence behavioural beliefs through the use of a questionnaire. This knowledge will inform the development of a PND adherence framework and the subsequent theory-based adjunct mobile application to support the wellbeing of women with PND by encouraging adherence to PND treatment. It will also help to decide on the factors and beliefs that should be supported or discouraged by a PND adherence framework and mobile application. Furthermore, identifying women’s beliefs and attitudes towards PND interventions could potentially benefit practitioners who intend to change or motivate the adherence behaviour.

Attitude towards a behaviour is assumed to be a function of beliefs about the behaviour’s likely consequences, together with the valence attached to those consequences (Ajzen, 2011). In this study, we assume that knowledge of beliefs and attitudes towards intervention outcome could predict factors that determine their behaviour towards treatment adherence. Fishbein advocates identifying salient beliefs from the intended population and developing suitable and appropriate materials based on the elicited beliefs (Fishbein, von Haeften, & Appleyard, 2001). Furthermore, a person may hold a positive attitude concerning a behaviour, but not always carry out their intentions towards it (Ajzen, 2011). In this context, a woman with PND might have positive intentions towards treatment, but there are many reasons as to why she does not adhere to it, and this can be classified as the degree of control that the woman has over behavioural performance. If a depressed woman has the capacity, skills, time, resources or whatever it takes to perform the adherence behaviour, then she will be able to carry out her intention, but not if some of these are lacking. However, women with PND are faced with barriers and undergo some changes after childbirth that could affect their adherence behaviour (de Graaf et al., 2009; Kaltenthaler et al., 2002). Previous research suggests that the more one knows about the influencing factors of a particular behaviour, the easier it will be to change
that behaviour (Mirkuzie et al., 2011). It is, therefore, important to identify the factors that inhibit adherence to prescribed PND interventions.

This part of the thesis documents the perception women with previous episodes of PND highlighting their concerns and experience with PND interventions. Factors that had been highlighted in the literature as possible factors for non-adherence to PND treatment were explored. The next sections will detail the aim and objectives, followed by the method used to collect data, results and finally the discussion of the research findings. The findings for each hypothesis will be discussed and placed within the context of the research question.

5.2. **Study aims and objectives**

This study seeks to investigate women’s behavioural and control beliefs about PND interventions to establish some of the factors that lead to treatment adherence and sustained outcome. The objectives are to identify the obstacles to the performance of adherence behaviour that should be discouraged within an adherence intervention. For women who are already motivated, the authors will also identify factors that could facilitate them to implement their intentions to adhere to treatment. This study specifically relates to the type of treatment used and its effectiveness, as opposed to relaying past experiences of PND.

5.3. **Research questions and hypothesis**

The study examines the existing aspects of support interventions that have been used for PND and if they have been found useful (behavioural beliefs and attitude as explained in chapter 4). Research on postnatal depression indicates that depressed women receiving treatment for PND expressed concerns about treatment lacking content specific to the postnatal period. This results in them trying different kinds of intervention that provides adaptation to their specific needs (O’Mahen et al., 2014). Boath and Henshaw (2001) suggest the exploration of integrated approaches that allow depressed women to choose an intervention that is most relevant to their need. Similarly, Rojas et al., (2007) found that when there was a record of high compliance in a multicomponent intervention that was supported by regular phone calls from trained mental health workers, where depressed women were constantly reminded about the need for taking medications as prescribed in sessions. It is noted that using multiple interventions is more effective on PND intervention outcome and therefore warrants further investigation. This study will identify the beliefs, and attitudes women have towards single and
multiple interventions and their outcomes. With this in mind, this study will ask the first research question:

Research Question 1: Can using different techniques from several interventions provide postnatal depressed women with the desired outcome?

This research question aims to investigate the effects of using single or multiple interventions for PND. It is assumed that using different techniques from several interventions might provide postnatal depressed women with the desired recovery. However, the effects of interventions on symptoms might be similar across intervention groups. It is important to identify how the effects of the intervention on PND symptoms differ for women who have previously used interventions. Therefore, the following three hypotheses will be tested in relation to the first research question.

Hypothesis 1: Women with PND have used multiple interventions to achieve a greater outcome.

Hypothesis 2: Using multiple interventions for a PND symptom aids the desired outcome.

Hypothesis 3: There is no difference in intervention outcome across PND interventions

Previous research noted that intervention delivery technique and depressed women’s non-adherence to treatment could be related to poor outcome (Pampallona et al., 2002; Gonzalez & Williams, 2005). Secondly, lack of adherence to treatment has been shown to increase the length of time spent in treatment for psychological disorders, as well as to decrease the long-term efficacy of the treatment (Dunn, 2002; Rigbi, Shalev-Mevorach, Taller, Taller, & Lerer, 2003). The second research question aims to examine the factors associated with increased PND intervention outcome.

Research Question 2: What are the factors that influence greater PND intervention outcomes?

For the second research question, we aim to identify the factors that influence sustained PND intervention outcomes. The delivery of intervention may prove difficult especially when balancing the demands of caring for infants with treatment process, and efforts required in
seeking help or treatment compliance (Glover, Onozawa & Hodgkinson, 2002; McCarthy & McMahon, 2008; Milgrom et al., 2011; Turner et al., 2008). In a qualitative study on women’s experience with online self-help CCBT program, adherence to treatment was reported as low, and this was attributed to the way the treatment was delivered and lack of support to adhere with intervention (Gerhards et al., 2010). Intervention delivery should be considered essential for sustaining treatment effect over the long-term (Cooper, Murray, Wilson & Romaniuk, 2003; Cuijpers et al., 2008; Gerhards et al., 2010). We assume that intervention delivery and accessibility factors (e.g. cost, location, duration) may have a potential impact on intervention outcomes. Therefore, the following four hypotheses are to be tested in relation to the second research question, aiming to investigate the factors that influence greater PND intervention outcomes.

**Hypothesis 4:** The delivery approach of intervention influence greater PND intervention outcomes.

**Hypothesis 5:** There is a positive relationship between adherence to intervention and greater PND outcomes.

**Hypothesis 6:** There is a positive relationship between the accessibility of interventions and sustained PND intervention outcomes.

**Hypothesis 7:** There is a significant positive relationship between PND symptoms factors that could impact intervention outcome.

Furthermore, it is assumed that a positive attitude towards intervention will influence the intention to use additional support. Research question three probes the relationship between women’s attitude towards intervention and the intention to use adjunct support.

**Research Question 3:** What is the relationship between attitude towards PND intervention and the intention to use an adjunct mobile application?

According to TPB, it is assumed that perceived attitude influences intention to perform a behaviour. The stronger a person’s intention to perform a behaviour the more likely the person will perform that behaviour. This question will help determine how the perceived attitude will influence depressed women’s intention to use an adjunct mobile application.
Hypothesis 8: More favourable attitude towards intervention outcome and greater behavioural control over the use of intervention would predict greater intention to use an adjunct mobile application for PND.

Hypothesis 9: There will be a positive intention to use of adjunct mobile application for PND

To investigate the relationship between attitude and the intention to use an adjunct mobile application.

Research Question 4: What are the factors that influence the intention to use an adjunct mobile application for PND?

This research will also aim to examine the factors that influence the intention to use an adjunct mobile application. The following hypothesis will be asked:

Hypothesis 10: Greater control over the use of intervention techniques would lead to greater intention to use an adjunct mobile application.

Furthermore, we assume that depressed women’s intention to use an adjunct mobile is measured by how useful they think the application will be.

Research Question 5: What is the relationship between the intention to use an adjunct mobile application and its perceived usefulness?

Hypothesis 11: There will be a positive linear relationship between the likelihood of using an adjunct mobile application and its perceived usefulness.

These eleven hypotheses are tested, and the results were to construct a list of accessible beliefs and subsequently developed into a set of requirements that informed the development of an adjunct mobile application for PND.

5.4. Method

The approach of this study is quantitative and the process adopted is sequential. An online questionnaire was used and delivered via Survey Monkey. Survey Monkey was used as a questionnaire tool because it allows research participants to speak in their own words, is
convenient, and its one of the most popular tools used in academic research within the University departments’ that the researcher is affiliated with; that being the School of Computing. Furthermore, it enables researchers to download results in a Microsoft Excel spreadsheet, which facilitates easier coding and sorting of data. As explained in Chapter 4, to preserve anonymity, the questionnaire tool was switched to “do not collect IP addresses”. The following section will discuss details of data collection, measures and procedure used to answer the research questions and hypothesis.

5.4.1. Pilot Study

It was identified that respondents might have other interpretation to written text such that what is clear to the researcher, may not convey the intended meaning to others. Therefore, a pilot study was conducted with five postnatal women and six members of staff in the School of Computing at the University of Portsmouth. Participants pointed out that the meaning of some questions was not clear and others spotted elements of redundancy. Subsequently, the researcher adjusted the wording and format where necessary and eliminated a few items. Results of this analysis informed the final questionnaire used in the study (see section B.1).

5.4.2. Recruitment

Respondents were recruited by advertising on UK-based social media platforms (Facebook and Twitter), sending email invitations to women who are members of parenting support groups and fertility forums. The method was deemed appropriate because several studies have shown that use of the internet, social media and telephone contact might be an appropriate means to gather data research on additional support for this non-help-seeking population, such as women suffering from PND (Dennis & Dowswell, 2013; Cacciola, 2014).

The recruitment for this study took place from February to May 2016. The UK based online support groups contacted for this study are described in the section E. Moderators of the groups (Support groups, Facebook groups and pages) were consulted concerning the research, before actively targeting potential participants. Once approval had been granted, invitations were appropriately amended according to the individual groups. Recruitment involved voluntary participation of women with previous diagnosis of PND yet have not suffered any symptoms in the last two years.
Interested participants provided informed consent before participating and then accessed information describing the aims and objectives of the study and eligibility (see section B.2). The survey had a statement ‘consent form’ (see section B.3) advising participants that by completing the survey, they had agreed to provide consent. The survey also offered to provide feedback to participants, if required and as such, participants are invited to provide their email address.

Given the possibility, albeit minimal, that participants may incur psychological stress about carrying out the survey, information was provided at the end of the survey, advising women where they could seek support (see section F). The survey is designed to exclude any women who have a current or recent diagnosis of PND. As previously mentioned the study utilized a questionnaire, it was recognised there may be a possibility that participants might have found that some of the study questions triggered distressing memories; therefore, the authors designed the questionnaire to ensure that questions related more to the type of therapy used and its effectiveness, as opposed to relaying past experiences of PND specifically. Participants were informed that they had the right to withdraw at any time while completing the questionnaire.

5.4.3. Instrument

Ajzen’s (2002) instructions for constructing a TPB questionnaire were adopted to develop items used to collect data on treatment adherence behaviour. This study is simply measuring the attitude towards PND treatment adherence and the perceived control beliefs; therefore, eight items were incorporated with, possible responses ranging from strongly disagree to strongly agree. Figure 4.3 demonstrates how the element of TPB was operationalised in the current study. The questionnaire included questions about the types of intervention participants have used in the past, the effectiveness of the intervention on wellbeing, the effect of the intervention on symptoms, factors that might cause non-adherence and demographics. See section B.1 for the questionnaire.

For this study, eight PND interventions are considered to identify participant’s attitude towards treatment adherence:

- Cognitive Behavioural Therapy (CBT),
- Medication (Med),
- Monitoring and Assistance (MA),
• Self-Help from peer group (SHP),
• Psycho-education,
• Wellbeing Therapy,
• Interpersonal Therapy (IPT),
• Problem Solving Therapy (PST)

The details of these interventions are briefly described in chapter two and detailed in full in the following studies: Klier et al. (2001), Cooper (2003), Milgrom, Ericksen, McCarthy, & Gemmill (2006), Pampallona et al. (2002) and Yonker et al. (2008). This study classified symptoms identified from literature (see chapter 2) as:

• Isolation,
• Poor communication,
• Prioritising demand,
• Relationships,
• Stress management,
• Negative thoughts and
• Self-confidence.

5.4.4. Participants

Potential participants were screened for eligibility using multiple questions in the questionnaire. It is of great ethical importance to ensure that women with a current or recent diagnosis of PND are eliminated from the study. To determine whether a participant is currently suffering or has recently suffered from PND, the authors asked the question “Do you presently suffer from postnatal depression”. Eligible participants were women with previous diagnosis of PND, yet who had not suffered any symptoms of PND in the last two years before recruitment. This study group was used because it places us in a position to explore women’s view about the short and long-term effectiveness of the intervention on their recovery from PND. Research shows that mothers do accurately recall their PND several years later (Cox et al., 1984). Women who currently suffer from PND, have experienced PND in the last two years, or any woman who has not received treatment for PND in the past were excluded from the study. Men were also excluded from the study.
5.4.5. Ethical approval

Ethical approval was obtained from the author’s University Ethics Committee (ID number - BO1. The ethical considerations relating to this research are addressed in chapter 4 of this thesis.

5.4.6. Sample

This study estimated a sample size of 382 postnatal mothers to achieve effect size. This is based on a population of about 70,000 women suffering from PND in the UK (Caramlau et al., 2011; Dennis, 2003; Evans et al., 2012; Glover et al., 2002), with 5% margin of error and confidence level of 95%. 460 women were invited and, in total, 181 participants started the survey. After screening for current or recent PND, 97 were not eligible for the study. Of those, 55 (30.4%) were excluded because they were current sufferers of PND, 11 because they had never suffered from PND and 23 (12.7%) because they had not received any treatment for PND. A further eight respondents that did not complete any further questions had to be excluded due to the lack of further responses to analyse. The final group of participants comprised 84 (46.4%) postnatal women (mean age = 32 years, range 27-41). It is important to note that not all participants responded to all questions asked. Table 5.1 presents further details on the number of included and excluded participants.

Table 5.1: Number of included and excluded women

<table>
<thead>
<tr>
<th>Excluded women</th>
<th>Included women</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women not suffering from PND</td>
<td>11</td>
<td>6.1</td>
</tr>
<tr>
<td>Women not treated for PND</td>
<td>23</td>
<td>12.7</td>
</tr>
<tr>
<td>Women excluded due to the lack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of further responses to analyse</td>
<td>8</td>
<td>4.4</td>
</tr>
<tr>
<td>Current sufferers</td>
<td>55</td>
<td>30.4</td>
</tr>
<tr>
<td>Treated and not currently suffering</td>
<td>84</td>
<td>46.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>97</strong></td>
<td><strong>84</strong></td>
</tr>
<tr>
<td><strong>Percentage</strong></td>
<td></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
5.4.7. Data Analysis

Throughout this study, the widely used IBM SPSS statistics package was used to analyse quantitative data (Brace, Kemp & Snelgar, 2012). For this study, an outcome is statistically significant if the significance level “p” is less than 0.05. This study explored the differences in scores of a non-parametric dependent variable between three or more groups of a single independent variable. Therefore, the Kruskal-Wallis test, which is a non-parametric equivalent of the between-subject analysis of variance (ANOVA) test, was employed to evaluate significant differences. The Kruskal-Wallis test only tells us that there is a difference, but does not tell us where the differences are according to each pair of analyses (Brace et al., 2012). Therefore, an additional Mann-Whitney U test was used to locate the differences, one for each pair of the groups.

Furthermore, this study measured the degree of relationship and association between symptoms and adherence variables. However, it is important to note that correlation does not imply causation, but will provide a measure of strength and direction of the relationship. The Pearson correlation was used for normal data. For non-parametric data, Kendall’s Tau-b test of correlation was used to predict the relationship between variables. The study assessed relationships regarding the positive or negative correlation coefficient (r). The correlation coefficient describes the strength of the association between two variables. It provides a direct representation of effect size. Using Cohen's (1988) conventions for categorising effects sizes, the study described the strength and size of the relationship for particular values of the correlation coefficient.

5.5. Results

5.5.1. Depressed women without treatment

Our study revealed that, despite effective treatment options, some women remain without treatment. Although those women who had PND and remained without treatment were excluded from the main part of this study (see table 5.2), our sample showed that 12.7% (23/181) of respondents fell into this category. Our findings agree with the literature that suggests that, despite effective intervention options, postnatal depressed women remain depressed without getting the treatment needed (Kaltenthaler et al., 2002; O'Mahen, 2013; Wan et al., 2008). However, a more positive reflection is that most sufferers do get at least one of a range of possible treatments.
Table 5.2: Data showing that some depressed women remain without treatment

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Included women</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women not suffering from PND</td>
<td>11</td>
<td></td>
<td>6.1</td>
</tr>
<tr>
<td><strong>Women not treated from PND</strong></td>
<td>23</td>
<td></td>
<td><strong>12.7</strong></td>
</tr>
<tr>
<td>Dropped out</td>
<td>8</td>
<td></td>
<td>4.4</td>
</tr>
<tr>
<td>Current sufferers</td>
<td>55</td>
<td></td>
<td>30.4</td>
</tr>
<tr>
<td>Treated and not currently suffering</td>
<td>84</td>
<td>84</td>
<td>46.4</td>
</tr>
<tr>
<td>Number of participants that started the survey</td>
<td>181</td>
<td>84</td>
<td>100.0</td>
</tr>
</tbody>
</table>

5.5.2. Hypothesis 1

The first hypothesis suggests that women with PND have used multiple interventions to achieve greater intervention outcome. To assess this hypothesis we computed the frequency and percentage of women that have used multiple interventions. Our data shows that 81% of depressed women rely on combinations of treatment strategies with Medication (Med) being the most common intervention that was combined. Fig. 5.2 shows the results of that women use multiple interventions for PND. Although, women found interventions most effective some women combined it with other intervention to achieve the desired outcome (see table 5.2). The shows that women found one intervention more effective than the other.

![Figure 5.1: Frequency of number women who have used multiple interventions](image)

Figure 5.1: Frequency of number women who have used multiple interventions
Table 5.3: Frequency of participants’ most effective intervention and percentage score of women that have used multiple interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Number of women who used intervention</th>
<th>Number of women for whom this was the most effective intervention</th>
<th>Number of women for who this was one of a set of multiple interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Behavioural Therapy</td>
<td>29</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Monitoring and assistance (GP, Nurse or Therapist)</td>
<td>37</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Medication</td>
<td>67</td>
<td>40</td>
<td>27</td>
</tr>
<tr>
<td>Psycho-education and information</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Self-help from peer group</td>
<td>26</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Interpersonal Therapy</td>
<td>7</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Wellbeing Therapy</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Problem Solving Therapy</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>176</strong></td>
<td><strong>79</strong></td>
<td><strong>64</strong></td>
</tr>
</tbody>
</table>

5.5.3. **Hypothesis 2**

The second hypothesis tested was that using multiple interventions for PND symptoms aids the desired outcome. The Kruskal-Wallis test was used to identify differences between using one intervention as opposed to combining multiple interventions for PND symptoms. The results show that there is no significant difference between using one, two, three, four, five or six interventions on PND symptoms. Non-significance was apparent across all the symptom factors except relationship: $\chi^2 (5) = 12.942, p = .024$, see table 5.4.

Table 5.4: Effects of using multiple interventions to aid symptoms

<table>
<thead>
<tr>
<th>Symptoms factors</th>
<th>Kruskal-Wallis test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H</td>
</tr>
<tr>
<td>Isolation</td>
<td>2.794</td>
</tr>
<tr>
<td>Communication</td>
<td>2.042</td>
</tr>
<tr>
<td>Prioritise demands</td>
<td>2.995</td>
</tr>
</tbody>
</table>
5.5.4. **Hypothesis 3**

The third hypothesis suggests that there is no difference in intervention outcome across PND interventions. Firstly, the frequency and percentage of women’s perception of intervention effects on symptoms were obtained (see table 5.5).

**Table 5.5: Frequencies of intervention and perceived effect on symptoms**

<table>
<thead>
<tr>
<th>Isolation</th>
<th>CBT Frequency (%)</th>
<th>MA Frequency (%)</th>
<th>Med Frequency (%)</th>
<th>SHP Frequency (%)</th>
<th>Other Frequency (%)</th>
<th>Total Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>1 (1)</td>
<td>3 (4)</td>
<td>4 (5)</td>
<td></td>
<td></td>
<td>4 (5)</td>
</tr>
<tr>
<td>Neutral</td>
<td>6 (8)</td>
<td>1 (1)</td>
<td>16 (8)</td>
<td>2 (3)</td>
<td>25 (32)</td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td>6 (8)</td>
<td>5 (6)</td>
<td>23 (29)</td>
<td>10 (13)</td>
<td>6 (8)</td>
<td>50 (63)</td>
</tr>
<tr>
<td>Total</td>
<td>12 (16)</td>
<td>6 (7)</td>
<td>39 (37)</td>
<td>11 (14)</td>
<td>11 (15)</td>
<td>79 (100)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication</th>
<th>CBT Frequency (%)</th>
<th>MA Frequency (%)</th>
<th>Med Frequency (%)</th>
<th>SHP Frequency (%)</th>
<th>Other Frequency (%)</th>
<th>Total Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>1 (1)</td>
<td>2 (3)</td>
<td>9 (11)</td>
<td>1 (1)</td>
<td>4 (5)</td>
<td>17 (21.5)</td>
</tr>
<tr>
<td>Neutral</td>
<td>4 (5)</td>
<td>-</td>
<td>11 (14)</td>
<td>-</td>
<td>2 (3)</td>
<td>17 (21.5)</td>
</tr>
<tr>
<td>Disagree</td>
<td>7 (9)</td>
<td>4 (5)</td>
<td>20 (25)</td>
<td>9 (11)</td>
<td>5 (6)</td>
<td>45 (57)</td>
</tr>
<tr>
<td>Total</td>
<td>12 (15)</td>
<td>6 (5)</td>
<td>40 (50)</td>
<td>10 (12)</td>
<td>11 (14)</td>
<td>79 (100)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prioritise demands</th>
<th>CBT Frequency (%)</th>
<th>MA Frequency (%)</th>
<th>Med Frequency (%)</th>
<th>SHP Frequency (%)</th>
<th>Other Frequency (%)</th>
<th>Total Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>2 (2.5)</td>
<td>2 (2.5)</td>
<td>5 (6.3)</td>
<td>-</td>
<td>4 (5.1)</td>
<td>13 (16.5)</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>Neutral</td>
<td>Disagree</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-------</td>
<td>---------</td>
<td>----------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Neutral</strong></td>
<td>2 (2.5)</td>
<td>2 (2.5)</td>
<td>13 (16.5)</td>
<td>2 (2.5)</td>
<td>22 (27.8)</td>
<td></td>
</tr>
<tr>
<td><strong>Disagree</strong></td>
<td>8 (10.1)</td>
<td>2 (2.5)</td>
<td>22 (27.8)</td>
<td>7 (8.9)</td>
<td>5 (6.3)</td>
<td>44 (55.7)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12 (15.2)</td>
<td>6 (7.6)</td>
<td>40 (50.6)</td>
<td>10 (12.7)</td>
<td>11 (13.9)</td>
<td>79 (100)</td>
</tr>
</tbody>
</table>

### Relationship

<table>
<thead>
<tr>
<th></th>
<th>CBT</th>
<th>MA</th>
<th>Med</th>
<th>SHP</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agree</strong></td>
<td>2 (2.5)</td>
<td>2 (2.5)</td>
<td>2 (2.5)</td>
<td>1 (1.3)</td>
<td>4 (5.1)</td>
<td>11 (16.5)</td>
</tr>
<tr>
<td><strong>Neutral</strong></td>
<td>1 (1.3)</td>
<td>2 (2.5)</td>
<td>11 (13.9)</td>
<td>2 (2.5)</td>
<td>-</td>
<td>16 (20.3)</td>
</tr>
<tr>
<td><strong>Disagree</strong></td>
<td>9 (11.4)</td>
<td>2 (2.5)</td>
<td>27 (32.2)</td>
<td>7 (8.9)</td>
<td>7 (8.9)</td>
<td>52 (65.8)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12 (15.2)</td>
<td>6 (7.6)</td>
<td>40 (50.6)</td>
<td>10 (12.7)</td>
<td>11 (13.9)</td>
<td>79 (100)</td>
</tr>
</tbody>
</table>

### Stress management

<table>
<thead>
<tr>
<th></th>
<th>CBT</th>
<th>MA</th>
<th>Med</th>
<th>SHP</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agree</strong></td>
<td>1 (1.3)</td>
<td>1 (1.3)</td>
<td>-</td>
<td>-</td>
<td>5 (6.3)</td>
<td>7 (8.9)</td>
</tr>
<tr>
<td><strong>Neutral</strong></td>
<td>1 (1.3)</td>
<td>1 (1.3)</td>
<td>4 (5.1)</td>
<td>5 (6.3)</td>
<td>2 (2.5)</td>
<td>13 (16.5)</td>
</tr>
<tr>
<td><strong>Disagree</strong></td>
<td>10 (12.7)</td>
<td>4 (5.1)</td>
<td>36 (45.6)</td>
<td>5 (6.3)</td>
<td>4 (5.1)</td>
<td>59 (74.7)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12 (15.2)</td>
<td>6 (7.6)</td>
<td>40 (50.6)</td>
<td>10 (12.7)</td>
<td>11 (13.9)</td>
<td>79 (100)</td>
</tr>
</tbody>
</table>

### Negative thoughts

<table>
<thead>
<tr>
<th></th>
<th>CBT</th>
<th>MA</th>
<th>Med</th>
<th>SHP</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agree</strong></td>
<td>-</td>
<td>1 (1.3)</td>
<td>-</td>
<td>-</td>
<td>4 (5.1)</td>
<td>5 (16.5)</td>
</tr>
<tr>
<td><strong>Neutral</strong></td>
<td>-</td>
<td>1 (1.3)</td>
<td>1 (1.3)</td>
<td>3 (3.8)</td>
<td>3 (3.8)</td>
<td>8 (10.1)</td>
</tr>
<tr>
<td><strong>Disagree</strong></td>
<td>12 (15.2)</td>
<td>4 (5.1)</td>
<td>39 (49.4)</td>
<td>7 (8.9)</td>
<td>4 (5.1)</td>
<td>66 (83.5)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12 (15.2)</td>
<td>6 (7.6)</td>
<td>40 (50.6)</td>
<td>10 (12.7)</td>
<td>11 (13.9)</td>
<td>79 (100)</td>
</tr>
</tbody>
</table>

### Self-confidence

<table>
<thead>
<tr>
<th></th>
<th>CBT</th>
<th>MA</th>
<th>Med</th>
<th>SHP</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agree</strong></td>
<td>1 (1.3)</td>
<td>2 (2.5)</td>
<td>3 (3.8)</td>
<td>1 (1.3)</td>
<td>4 (5.1)</td>
<td>11 (13.9)</td>
</tr>
</tbody>
</table>
The above table shows that all women reported having all the symptoms factors. However, the effects of interventions on symptoms might be similar across intervention groups. A further statistical test was carried out to identify how the effects of the intervention on PND symptoms differ amongst women. Employing the Kruskal-Wallis non-parametric test, significant differences were found between intervention group with regards to isolation, communication and managing negative thoughts except for prioritising demands relationship, self-confidence and stress management (see table 5.6). Subsequent Mann-Witney U-test showed that these differences were particularly apparent between CBT and SHP ($z = -2.318, p = 0.02$), MED and SHP ($z = -2.540, p = 0.01$). Concerning scores on isolation and communication differences were found between the MED and SHP categories ($z = -2.863, p < 0.05$) and between managing negative thought CBT and SHP ($z = -2.451, p = 0.02$). Although results were between neutral and disagree, it does show that various interventions have different effects on symptoms.

**Table 5.6: Effects of intervention on symptoms**

<table>
<thead>
<tr>
<th>Symptoms factors</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Kruskal-Wallis</th>
<th>Mann-Whitney</th>
<th>Between categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>79</td>
<td>1.9494</td>
<td>.89010</td>
<td>8.40(3)</td>
<td>0.04</td>
<td>CBT – SHP**, SHP - Med**</td>
</tr>
<tr>
<td>Communication</td>
<td>79</td>
<td>2.4051</td>
<td>1.14935</td>
<td>8.52(3)</td>
<td>0.04</td>
<td>SHP - Med**</td>
</tr>
<tr>
<td>Prioritise demands</td>
<td>79</td>
<td>2.3544</td>
<td>1.00049</td>
<td>3.33(3)</td>
<td>0.34</td>
<td>-</td>
</tr>
<tr>
<td>Relationship</td>
<td>79</td>
<td>2.1266</td>
<td>1.01738</td>
<td>4.92(3)</td>
<td>0.18</td>
<td>-</td>
</tr>
<tr>
<td>Stress management</td>
<td>79</td>
<td>1.9114</td>
<td>.89428</td>
<td>5.06(3)</td>
<td>0.17</td>
<td>-</td>
</tr>
<tr>
<td>Manage negative thoughts</td>
<td>79</td>
<td>1.7342</td>
<td>.79597</td>
<td>8.53(3)</td>
<td>0.04</td>
<td>CBT – SHP**</td>
</tr>
<tr>
<td>Self confidence</td>
<td>79</td>
<td>2.1139</td>
<td>1.04988</td>
<td>4.14(3)</td>
<td>0.25</td>
<td>-</td>
</tr>
</tbody>
</table>
The ranked mean difference is significant at P < 0.05 (two-tailed)

## 5.5.5. Hypothesis 4

Different approaches are applied for delivering treatment to women suffering from PND. Table 5.7 below shows that 80% participants received intervention with help from sessions with a therapist (ST) or home visits from healthcare workers (HVHW) while the remaining participants received an intervention via structured sessions with peers (SSP) or through an online self-help program (OSHP) (M= 1.81, SD = .85). The hypothesis tested is that the approach of delivery of intervention might influence greater PND outcome. However, the effect of delivery on symptoms might be similar across the delivery group. The Kruskal-Wallis test was used to examine the effect of intervention delivery method on intervention effects on PND symptom.

<table>
<thead>
<tr>
<th>Table 5.7: Frequency of intervention delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Help from sessions with therapist (such as GP, Psychologist)</td>
</tr>
<tr>
<td>Help from home-visits from healthcare workers</td>
</tr>
<tr>
<td>Help from structured sessions with other women suffering from</td>
</tr>
<tr>
<td>Help from online self-help program</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5.8: Effects of intervention delivery of PND outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms factors</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
</tbody>
</table>

** The ranked mean difference is significant at P < 0.05 (two-tailed)
Table 5.8 confirms that there was also no significant difference found for all the symptom factors except for communication ($\chi^2 (3) = 11.127, p = .011$) which shows a difference between the delivery groups. Furthermore, the Mann-Witney U test was used to locate the difference in communication. The results shows that there was a significant difference in between HVHW and SSP ($z = -2.848, p = 0.004, N1 = 24; N2 = 8, r = .50$), ST and SSP ($z = -2.773, p = 0.010, N1 = 25; N2 = 8, r = .48$). We have used the median data from table 5.7 to conclude that those in the HVHW and ST group are less satisfied with improvement on symptoms than those in the SSP. The same results were found for the OSHP and SSP group $z = -2.060, p = 0.039, N1 = 3; N2 = 8, r = .62$.

5.5.6. Hypothesis 5

Hypothesis five stated that there is a positive relationship between adherence to intervention and greater PND outcomes. To evaluate this, the frequency of how participants’ followed instructions was rated against symptoms factors.
The results shown in table 5.9 above revealed that there was a weak, but non-significant, correlation between frequency of following instructions and the effect on symptoms factors.

### 5.5.7. Hypothesis 6

Hypothesis six aimed to evaluate the relationship between accessibility of intervention and PND outcome. To evaluate this hypothesis, factors that were considered were the cost of receiving intervention; duration of appointments; waiting times; and the convenience of the location where the intervention is received. All women in the study reported facing the control factors used in this study.

<table>
<thead>
<tr>
<th>Symptoms factors</th>
<th>Kendall's Tau_b Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost factor</td>
</tr>
<tr>
<td></td>
<td>r</td>
</tr>
<tr>
<td>Isolation</td>
<td>.151</td>
</tr>
<tr>
<td>Communication</td>
<td>-.070</td>
</tr>
<tr>
<td>Prioritise demands</td>
<td>.059</td>
</tr>
<tr>
<td>Relationship</td>
<td>.015</td>
</tr>
<tr>
<td>Stress management</td>
<td>.023</td>
</tr>
<tr>
<td>Manage negative thoughts</td>
<td>.006</td>
</tr>
<tr>
<td>Self confidence</td>
<td>.068</td>
</tr>
</tbody>
</table>

The Kendall’s Tau-b test shows (table 5.10) that there was a weak, but non-significant, correlation between the cost; duration, waiting times, the location of receiving the intervention and the effect on symptoms factors. Although the correlation between the location and stress management was significant, it only had a small effect ($r = 0.249$, $p = .01$).
5.5.8. Hypothesis 7

The soothing of one PND symptom might alleviate the effect of other symptoms, but there might be no linear relationship between PND symptoms. To test the hypothesis that there is a significant positive relationship between PND symptoms, the Pearson correlation coefficient was used to examine the degree of association between symptom factors. This test was used because there was a normal distribution of data.

Table 5.11: Pearson correlation coefficient between prioritising demands, communication, isolation, relationship with children, managing stress, negative thoughts and having faith in self for women with postnatal depression (N=79).

<table>
<thead>
<tr>
<th>Symptom factors</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Communication</td>
<td>-</td>
<td>.208</td>
<td>.464**</td>
<td>.438**</td>
<td>.335**</td>
<td>.301**</td>
<td>.493**</td>
</tr>
<tr>
<td>2. Isolation</td>
<td>-</td>
<td>.164</td>
<td>.177</td>
<td>.252*</td>
<td>.325**</td>
<td>.308*</td>
<td></td>
</tr>
<tr>
<td>3. Prioritising demands</td>
<td>-</td>
<td>.434**</td>
<td>.408**</td>
<td>.329**</td>
<td>.474**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Relationships</td>
<td>-</td>
<td>.520**</td>
<td>.390**</td>
<td>.550**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Managing stress</td>
<td>-</td>
<td>.777**</td>
<td>.557**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Managing negative thoughts</td>
<td>-</td>
<td>.512**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Self-confidence</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** p < .01 (2-tailed) * p < .05 (2-tailed)

Prioritising demands was found to be significantly and positively correlated with talking to other people ($r (n=79) = 0.464, p < 0.001$); relationship with children ($r(n=79) = 0.434, p < 0.001$); reduced stress ($r(n=79) = 0.408, p < 0.001$); managing negative thoughts ($r(n=79) = 0.329, p < 0.001$) and self-confidence ($r(n=79) = 0.474, p < 0.001$). These indicate that depressed women with higher level of prioritising their demands tended to have a good relationship with their children, have reduced stress, are able to manage negative thoughts as well as have faith in themselves. However, isolation was found to have a very weak relationship with prioritising demands ($r(n=79) = 0.164, p = 0.148$), talking to other people ($r(n=79) = 0.208, p = 0.065$), and relationship with children ($r(n=79) = 0.177, p = 0.119$).
5.5.9. Hypothesis 8

Ajzen's (1991) TPB asserts that past behaviour can be a predictor of future behaviour. This hypothesis tested that a more favourable attitude towards intervention outcome and greater behavioural control over the use of intervention would predict greater intention to use an adjunct mobile application for PND. As recommended by Ajzen (2006) belief scores are calculated by multiplying or adding the relevant evaluation score on the Likert scale. The resulting sum is used to create the overall score, so a higher score reflects a positive attitude to adjunct mobile application.

Table 5.12: Women intention to use an adjunct mobile application

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Likelihood of using an adjunct mobile application</th>
<th>Total / Number of women for whom this was the most effective intervention</th>
<th>% of women likely to use mobile application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unlikely</td>
<td>Neutral</td>
<td>Likely</td>
</tr>
<tr>
<td>Cognitive Behavioural Therapy</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Monitoring and assistance (GP, Nurse or Therapist)</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Medication</td>
<td>2</td>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td>Self-help from peer group</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6</td>
<td>9</td>
<td>62</td>
</tr>
</tbody>
</table>

The results in table 5.12 show that 81% of the participants who have used interventions and found them most effective have an intention to use a mobile application as adjunct support.

5.5.10. Hypothesis 9:

A Kruskal-Wallis test was conducted to test the hypothesis that women will use a mobile application as additional support. To evaluate this hypothesis, the following likelihood factors were considered benefits of using a mobile application as additional support: practising
recovery techniques; support with adherence; good parenting practices reminder; engaging in previously valued activities and seeking support from family.

Table 5.13: Results for likelihood of using adjunct mobile application

<table>
<thead>
<tr>
<th>Likelihood of use factors</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Kruskal-Wallis H (d.f.)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practicing recovery techniques</td>
<td>77</td>
<td>3.5195</td>
<td>.99486</td>
<td>19.98(4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Support with adherence</td>
<td>77</td>
<td>3.7922</td>
<td>.93665</td>
<td>19.15(4)</td>
<td>0.001</td>
</tr>
<tr>
<td>Good parenting practices reminder</td>
<td>77</td>
<td>3.5325</td>
<td>.91168</td>
<td>23.92(4)</td>
<td>0.000</td>
</tr>
<tr>
<td>Engaging in previously valued activities</td>
<td>77</td>
<td>3.7922</td>
<td>.84818</td>
<td>12.70(4)</td>
<td>0.013</td>
</tr>
<tr>
<td>Seeking support from family</td>
<td>77</td>
<td>3.5844</td>
<td>1.03047</td>
<td>17.88(4)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

As seen in table 5.13, using the Kruskal-Wallis test, significant differences were found between the categories with regards to all score on the likelihood of using a mobile application as additional support. Based on the mean rank the results indicate that there is a positive perception toward the use of mobile application if it can address the likelihood factors.

5.5.11. Hypothesis 10:

Hypothesis ten stated that greater control over the use of intervention techniques would lead to greater intention to use an adjunct mobile application. As seen in table 5.14, to test this hypothesis, a correlation was carried out between the frequency of using an intervention, the frequency of following instructions and the likelihood of using a mobile application as additional support.

Table 5.14: Control over using prescribed intervention

<table>
<thead>
<tr>
<th>Factors</th>
<th>Kendall’s tau_b Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
</tr>
<tr>
<td>Frequency of using intervention</td>
<td>.004</td>
</tr>
<tr>
<td>Frequency of following intervention instructions</td>
<td>-0.28</td>
</tr>
</tbody>
</table>
5.5.12. **Hypothesis 11:**

The intention to use a mobile application as additional support for PND might be associated to its perceived usefulness. To test the hypothesis that there is a linear relationship between the likelihood of using a mobile application as additional support and the perceived usefulness of an adjunct PND application, the Pearson correlation was performed. The use of mobile application was found to be positively correlated with its perceived usefulness \( r (n=79) = 0.434, p < 0.001 \). This indicates that depressed women who accept to use a mobile app as additional support tend to have higher perceived usefulness of a mobile app as additional support. In other words, these two variables are positively correlated. The interaction of a linear correlation is displayed in the graph in figure 5.3.
Discussion

5.6.1. Research Question 1

It was expected that using different techniques from several interventions will provide postnatal depressed women with their desired outcome. Also, we expected that the effects of interventions on symptoms would be different across the treatment groups. The results show that there is a belief that combining multiple interventions will aid the desired outcome. From the literature, there are several possible reasons for this, including:

- the poor patient-doctor relationship,
- negative experiences with seeking help in the past,
- long waiting list for treatments,
• location convenience, and
• perceived stigma

In addition, perceived stigma can lead to women avoiding treatments and interfere with their ability to attend regular scheduled appointment (Dennis & Chung-Lee, 2006; de Graaf et al., 2009; Christensen, Griffiths & Farrer, 2009; Knudson-Martins & Silverstone, 2009; Gerhards et al., 2010; Merry et al., 2012; Pampallona et al., 2002).

It is clear that using multiple interventions does not have any significant effect on PND treatment outcome, but different intervention has a different level of effect on PND symptoms. Although this finding does not align with previous research literature, however, those hypotheses demonstrate that the option for multiple interventions should be provided for PND. Therefore rather than providing women with a single intervention for all PND symptoms, there should be a multiple choice that provides adaption to their specific needs such as using different interventions for different symptoms. This should give them the opportunity to have control over their desired intervention outcome.

5.6.2. Research Question 2

We expected that intervention delivery, adherence and accessibility will have a potential impact on intervention outcome. This study identified a list of the common factors and relationships that affect PND intervention outcome. Firstly, if the intervention delivery approach fits well with depressed women’s demanding responsibility, then there will be a greater intervention outcome. The results show that there no significant effect of delivery on some of the symptoms, however, it is significant to note that many of the women combined multiple delivery methods. One possible explanation for this is their busy schedules and overwhelming responsibilities, therefore, they are unable to fit the delivered sessions into their schedules. Secondly, if women adhere to intervention instructions and techniques, there will be more significant intervention outcome. However, results show that these did not have any relationship with PND symptoms. Finally, we assumed that the accessibility factors (cost, duration, waiting times and intervention location) would have a relationship with intervention outcome. This study suggests that the cost, duration, waiting times and intervention location are a determinant factor to greater PND outcome. Identifying and breaking down treatment accessibility factors into specific and manageable solutions may facilitate the ability for women to manage barriers and act on that recognition by seeking alternatives. This may mean that women feel less burdened when they are not coping with accessibility factors and be willing
to seek alternatives. While most PND intervention takes account of accessibility, it is also important that these are associated with the delivery of the intervention.

5.6.3. Research Question 3

The third research question for this study aimed to investigate the relationship between women’s attitude towards intervention and their intention to use an adjunct mobile application. The eighth and ninth hypothesis was supported by the data. There were strong intentions to use a mobile application as adjunct support as well as the positive perception of its usefulness. This suggests that there is a strong likelihood that depressed women will use a mobile application as additional support for PND.

5.6.4. Research Question 4

This question aimed to determine the factors that influence the intention to use an adjunct mobile application. It is assumed that greater control over the use of intervention techniques will influence positive intentions. This was not statistically significant with a very weak relationship. However, the result explains 72% and 92% of the variance in the intent to frequently use intervention and follow instruction. Therefore, we suggest that providing the user with a structured intervention plan will increase their intentions. The intention to use adjunct support influences its perceived usefulness demonstrated by the data, as it was statistically significant. This means that women who accept adjunct mobile application will probably find it useful.

5.6.5. Summary

This study documents the beliefs and factors that might determine adherence to PND treatment, and ensure increased sustained outcome. Firstly, a favourable attitude towards combining multiple interventions influences the actual adherence behaviour. There are several possible reasons why depressed women combine interventions, one being seeking support for normalisation of their mothering (O’Mahen et al., 2014). Previous research has shown that many women begin to incorporate alternate plans after the initial core sessions of their first intervention (Christensen, Griffiths, & Farrer, 2009; O'Mahen et al., 2014). A poor patient-doctor relationship might cause some women to be inconsistent in attending treatment sessions, thus finding themselves using alternative treatments. In previous research, women have expressed negative experiences of seeking help, and this is particularly likely to cause
them to seek additional treatments. Long waiting lists for treatments might be a barrier; therefore, they then seek additional support during waiting times. In some cases, treatments are not equivalently distributed geographically (Goodman 2009; Payne & Myhr, 2010). Finally, perceived stigma can also lead to women seeking additional support that will provide the level of anonymity they require (Dennis & Chung-Lee, 2006; Goodman, 2009; O’Mahen et al., 2014). Although our results show that combining multiple interventions does not have any significant effect on symptoms, the authors identified, however, that different interventions have different levels of effect on PND symptoms, therefore combining multiple interventions should be increased. This is further supported by research that suggested that to improve adherence; medication should be combined with other support strategies such automatic reminders, reminder packaging, medication boxes, device aids, counselling, telephone support, patient education etc., (Desteghe et al., 2017).

In this present study, women believe that the soothing of one symptom factor alleviates the effects of other symptoms. The authors identified a weak relationship between symptoms; this could mean that women are encouraged to adhere or not when the effect of treatment on one or more symptoms is obvious. This is similar to a study that revealed that it was only after women got into a supportive treatment relationship and improved their communication that they felt able to disclose their distress to others (McCarthy & McMahon, 2008). However, further study may be needed to highlight the factors that suggest the relationship between PND symptoms and the effect they have on each other.

Another strength of this study is that treatment cost, duration, location and waiting time, identified as control factors that inhibit adherence to PND treatment, are not related to increased adherence, but not in all cases. One possible explanation is that these factors should not hinder women from adhering to prescribed treatments. However, the location where intervention is received is seen to have a relationship with stress management; therefore, it should be recognised that there may be a possibility that depressed women become distressed by the location of receiving treatment. This could be due to transportation difficulties faced by some women. In regards to location, studies have documented the inability of women to attend regularly scheduled appointments (Goodman, 2009; O’Mahen et al., 2014). Additionally, this might mean that adjunct support should be provided as a control measure in the event they should become distressed by the treatment location. It is also useful to provide guidance as moderator of intention-behaviour and, thus, this might enhance treatment uptake and retention (Cuijpers et al., 2010; O’Mahen et al., 2014). This compares favourably with other research which suggests that only women who get a supportive treatment can show sustained outcome (Cuijpers et al., 2008; O’Mahen et al., 2014; McCarthy & McMahon, 2008).
Furthermore, following instructions as prescribed by practitioners did not affect PND symptoms. The underlying causes as to why following instructions did not affect symptom are still unclear. Therefore, the authors are careful in making our conclusions on this finding.

5.7. Implications

This study identified women’s attitudes towards postnatal depression interventions and the factors that could motivate improved adherence. A knowledge of these factors will allow the development of a set of guidelines which can inform the development of an adjunct mobile application for postnatal depression and future research. This will also facilitate the development of a mobile application that is tailored towards positive treatment adherence attitudes. Furthermore, it will potentially support future applications for a larger study to undertake a full trial of mobile applications for PND.

5.8. Limitations

Limitations of the current study are largely related to the fact that not all participants provided us with a complete data set. Although all participants satisfied the eligibility criteria, the women who completed the study are best considered a convenient sample that may not be generalised to all postnatal depressed mothers. Finally, it is possible that the use of only two TPB constructs (behavioural and control beliefs) might have influenced the ability to identify more factors that facilitate or inhibit adherence behaviour.

5.9. Conclusion

This study has identified the behavioural beliefs and control factors that might predict the intention to adherence to PND treatments. Firstly, increasing access to adjunct support for PND has the potential to influence adherence positively, and long-term sustained treatment outcomes. In particular, providing an intervention that combines support features of several interventions is recommended for increased adherence. This intervention could also provide the flexibility of treatment adaptation. Additionally, it may circumvent many of the barriers to treatment delivery and motivate women to self-manage their wellbeing as well as give them access to supplementary wellbeing support.

It is essential that the option to combine multiple interventions should also be balanced, this could mean that it should not be encouraged or discouraged. This is because combining
multiple interventions does not have any significant effect on symptoms; however, different interventions have different levels of effect on PND symptoms. Therefore, the authors recommend a platform that will facilitate using additional support to prescribed treatments for PND. This is in line with a growing body of research demonstrating that the provision of additional support to prescribed treatment could enhance achieving the desired outcome and sustained effect (Broom, Ladley, Rhyne, & Halloran, 2015). Adjunct treatment needs to remain available to women receiving the intervention, both during and after the intervention has ended (Turner, Chew-Graham, & Folkes, 2010). The effect of adjunct support was revealed in a study that recorded high compliance (Rojas et al., 2007). The multicomponent intervention used in that study was supported by regular phone calls from trained mental health workers, and depressed women were constantly reminded in their sessions about the need to take medications as prescribed (Rojas et al., 2007). The authors also recommend that, rather than providing women with a single intervention for all PND symptoms, there should be a multiple choice option that is open to adapting support to depressed women's specific needs. This should hopefully give them the opportunity to have control over their desired intervention outcome. Furthermore, this study demonstrated that a greater guidance tool designed to make treatment effect on symptoms noticeable could be beneficial and help control adherence behaviour. A structured support plan is viewed as a behavioural control tool, critical for achieving increased treatment understanding, self-management and adherence.

The findings from this study enabled the researcher to conceptualize factors that could potentially impact adherence to PND treatments. These factors were considered by identifying the beliefs of women on PND intervention. Based on these, our intention of developing a treatment adherence intervention tool will include:

- Offering multiple intervention choices
- Discussing the treatment delivery method.
- Associating delivery with flexible delivery options.
- Discussing options for adjunct support, when accessibility factors are no convenient.
- Discuss the effect of intervention on symptoms.
- Discuss intervention and usage plan

Given these promising findings, there is a need to develop and evaluate methods of promoting adherence and sustained treatment outcome in the PND population. Mobile Health is growing as a method to improve adherence and health outcomes. An adjunct mobile application is one method that may hold the promise of doing such. Developing a suitable and appropriate mobile
application is desirable, given its potential to increase adherence to the behaviour being promoted (Desteghe et al., 2017). This tool could support individuals with treatment/work already offered by practitioners, thus allowing sessions to be offered at a reduced frequency, duration and a cheaper cost and convenient location. To develop a mobile health intervention that will increase adherence, using a theory-based approach, this study sought to understand women’s perspective on obstacles to the performance of adherence behaviour that should be discouraged within the mobile application as well as factors that could facilitate them to implement their intentions to adhere to treatment. Based on our findings, we recommend that the development of a PND adherence mobile application should include features designed to:

- Help manage and monitor the use of multiple interventions.
- Keep a record and manage the impact of symptoms so that changes are noticeable.
- Keep records of prescription instructions and provide positive prompts to users for better communication.
- Include prompts and reminders as a means of self-guidance.
- Help users stay in contact with healthcare providers, family and friends when further guidance or help is needed.

Additionally, research has shown that self-incentives are key motivators and successful in changing health behaviours, adherence to daily care and improve health outcome. As a result of this insight we recommend that the mobile app should also include a feature that is:

- Related to self-incentives and will make the environment enjoyable and stimulating for users.

The current findings highlight beliefs about PND interventions that are necessary for developing adherence behaviour change intervention for this population. These findings will inform the design of an adjunct mobile application for PND. However, there is a need to establish the suitability and appropriateness of a mobile application. The mobile application should be evaluated for suitability and appropriateness to enhance the likelihood that the tool can effectively change behaviour. Further research is also needed to determine the acceptance of such a mobile application by both women with PND and practitioners. Such research should allow us to establish the requirements under which a mobile application for PND may be offered as effective and accessible support.
6. The perception of professional’s on Postnatal Depression interventions

6.1. Introduction

As discussed in chapter 4, the intention to perform a behaviour is potentially affected by people with whom people have close relationships. In this context, we assume that the practitioners to be interviewed on their perception of PND interventions are significant and have a considerable influence on women’s decision to adhere to treatments. The kind of information given by practitioners to postnatal depressed women makes up the opinion about what is normal (Ajzen, 2006). In this study, we capitalise on the perception of practitioners for improving treatment adherence behaviour. This will include practitioners’ view of interventions, techniques and the potential use of a mobile application as additional support for the treatment of PND. Practitioners are in the best position to depict the kind of mentality and conviction that is typical for PND. Secondly, we envisage that practitioners can explain both the obstacles and satisfaction for effectiveness women gain from PND interventions and wellbeing techniques.

6.2. Aims and objectives

This study aims to understand the type of information, interventions and techniques that professionals share with depressed women to ensure adherence to PND treatments. Identifying these will help decide on the type of factors that should be considered by an adherence intervention and subsequent adjunct mobile application for PND.

6.3. Research question

This study followed a deductive approach, so therefore, it began with the following research questions:

1. Can using different techniques from several interventions provide postnatal depressed women with the desired outcome?
2. What are the factors that influence greater PND intervention outcomes?
3. What are the factors that influence the intention to use an adjunct mobile application for PND?
6.4. Method

It was mentioned in section 4.10.2.2 that IPA was used in this study because it offers an opportunity to develop an understanding of participants view. IPA is a qualitative research method committed to the examination of how people make sense of their experiences. Data collection for this, as for most IPA studies is through semi-structured interviews (Smith et al., 2009). In this study, semi-structured interviews were conducted with practitioners in the field who have experience providing support for women suffering from PND. This method was used to collect data relating to the subjective norms of PND intervention and techniques.

Semi-structured interviews will enable professionals to express themselves and convey their individual experiences and interpretations, thus facilitating rapport and addressing the research questions (Smith et al., 2009). This method of data collection encourages participants to talk freely about what is important to them, hence, the researcher can then gain a deeper understanding of their opinion. The interviews included closed questions as well as open-ended questions to enable a variety of responses that allowed for richness and saturation of data. The interview questions were sent to professionals in advance to enable them to read through before the actual interview took place. Interviews were recorded using Callnote. Callnote is call recording software that lets users’ record Skype conversations. It helps review what was said during interviews, double-check details, or just plain remember what was said by whom, when or even why.

6.4.1. Ethical approval

This study was given ethical approval by the ethical review board of the University of Portsmouth, see section A for ethical approval (Reference: OO2). A full description of ethical consideration relating to this research can be found in chapter four of this thesis.

6.4.2. Recruitment

The majority of professionals in this study are currently participating in PND social media (Facebook and Twitter) / support groups and make their contact details available. Details of the group can be found in section E. Participants were contacted and invited by the researcher to participate in the study. Information sheet and consent forms were sent to the participant in advance via their profiles on support groups, social media or email address that they have made public (see section C.2, C.3 for information sheet and consent forms). The interview
information sheet advised participants that by taking part in the interview, they are implicitly providing consent. Participants were told that they had the right to withdraw at any time during the interview. Debrief offered to provide feedback to the participant if desired (see C.4). Participants with whom we have fully completed interview were given up to 3 months from the date of interview to withdraw from the study.

6.4.3. Data management

Data is stored securely and protected from loss, unlawful or unethical access, and by all other applicable requirements of the regulatory environment. Data and responses collected were encrypted on a USB drive and stored within a filing cabinet in a locked office within the School of Computing University of Portsmouth, and only the named researcher had access to this. This data is accessed only via a password-protected computer. Electronic files were deleted from computer hard-drives and servers when required. All data will be held securely for a minimum of 4 years following the publication of reports or articles resulting from data generation and then securely destroyed. The exception to this will be the University, who to the best of our knowledge does not provide a policy on data destruction. We aim to destroy data permanently and irreversibly. Methods may include, electronic data will be deleted from computer hard-drives and servers, overwriting data with a series of characters or reformatting the disk (destroying everything on it).

6.4.4. Participants

The subjects in the present study were experienced professionals that are members of PND support groups, forums or provide support for PND via social media pages (Facebook and Twitter). For all subjects, this included therapist, GP’s, health visitors and midwives. Although subjects may coincidentally work for the NHS, these are people who have of their volition made themselves available for advice, so they were not recruited via the NHS. All participants had an understanding of the aspects of intervention that are important to women with PND.

Table 6.1 details the type of participant, the type of therapy they use for clients, the frequency of appointment with each client and duration of each appointment. For this study, semi-structured interviews were carried out with six participants. Six participants were considered to be a good sample size to make possible the in-depth analysis of each care while allowing some comparing and contrasting within the sample and some degree of generalisation.
Participants in this study included four therapists and two midwives. Participants are given a pseudo name for this study.

Table 6.1: Participants information

<table>
<thead>
<tr>
<th>Participant</th>
<th>Participant role</th>
<th>Type of intervention delivered</th>
<th>Frequency of appointments</th>
<th>Duration of each appointment in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philip</td>
<td>Academic psychologist specialising in mental health, particularly perinatal mental illness and young people's mental health.</td>
<td>Talking Therapy and Medication</td>
<td>3 months</td>
<td>1</td>
</tr>
<tr>
<td>Zain</td>
<td>Experienced antenatal and postnatal Depression therapist</td>
<td>Cognitive Behavioural Therapy and Psycho-Education</td>
<td>Varies</td>
<td>1</td>
</tr>
<tr>
<td>Sharon</td>
<td>Therapist</td>
<td>Cognitive Behavioural Therapy and Psyco-Education Online support</td>
<td>Varies</td>
<td>1</td>
</tr>
<tr>
<td>Barbra</td>
<td>Psychotherapist and hypnotherapist with a speciality in the Psychology of Parenthood.</td>
<td>Psycho-education, Interpersonal therapy, Hypnosis, Problem-solving therapy</td>
<td>Varies</td>
<td>1.5</td>
</tr>
<tr>
<td>Chloe</td>
<td>Mid-wife</td>
<td>Talking Therapy</td>
<td>6 months</td>
<td>1</td>
</tr>
<tr>
<td>Sean</td>
<td>Mid-wife</td>
<td>Talking Therapy</td>
<td>12 months</td>
<td>1</td>
</tr>
</tbody>
</table>

6.4.5. Data analysis

Thematic analysis was used for the interview data. Interview recordings were transcribed verbatim; open codes were created for each interview and created into categories. These categories were then grouped to develop themes. Results are presented in researcher's interpretation and linked to the existing research literature in the discussion section. As Smith and colleagues (2009) point out, the process of the analysis is iterative, the process of analysis will involve continually going back and forth from the thematic organization to the transcripts and back, to check that the themes respect the participants' voices.
6.5. Results

The result section presents the researcher’s interpretation of the interviews. These understandings will be linked to the existing research literature in the discussion section. The themes repeatedly were reformulated to incorporate the emerging data. During the analysis of data, themes emerged which were continuously organised and reorganised within a developing thematic hierarchy. When words are omitted dots will be used “…” and identifying data has been changed to protect confidentiality.

6.5.1. Postnatal depressed women without treatment

Participant in this study revealed that they are aware that some women suffer from PND and remain without treatment. This was related to the stigma of PND, trust in getting the right help that they require or women wanting to get better without intervention. Below are some quotes from the participants articulating reasons why some women remain without treatment.

“Yes, some clients suffer from PND remain without treatment, but that is not very useful. Some of them are just very protective and do not trust that they can get help”…

Sharon

“I totally agree, some of these women might get better on their own without treatment, but that will take very long time”…Barbra

Sharon expressed that it is not very useful to remain without treatments. This may be seen to convey the importance of making sure that women are aware of the negative impact of PND on herself, her infant and family as well as the benefits of receiving PND treatments. Later in the quote, she emphasised on “protective” and “trust”. These suggest that by not seeking help there are still some factors that create fear. There is a need to build a relationship, reassurance and create confidence in women when providing support to them. Women are more likely to adhere to the treatment if they can engage with treatment facilitator and are extremely positive about their relationships with their practitioner. Although Barbra stated that some women get better without treatment, she expressed her concern that, that it takes a very long time. This use of “very” conveys emphasis and concern that it is not a good decision for women to remain without.
### 6.5.2. Theme 1: Managing wellbeing independently

Despite the variability in the duration of appointment and frequency of facilitating intervention, five professionals revealed that appointments would initially start at one hour, weekly. They expect mothers to be able to self-manage their wellbeing independently as the number of appointment increases. This theme will look at some of the relevant quotes articulating this aspect as significant.

“…It would initially start out, usually once a week and keeps stretching out so that they are learning how to manage their health on their own”…Sharon

“Someone might continue on a weekly basis; it really depends on what state of mind they are when they started. If they are feeling better and starting to feel strong and confident to manage their health, then we go to every two weeks”….Barbra

“Initially we have several interactions, it really depends on the support required and how they are able to help themselves” ....Zain

The repeated use of “manage” seemed to be an important aspect for professionals because they expect depressed mothers to increase their level of self-management after a couple of appointments. When asked how often they think their clients will do prescribed home treatment between appointments, 83% of the professionals thought that women would not practice homework between appointments. Some of the reasons why professionals think women will not practice at home are due to, lack of information on the benefits of doing homework and trust.

“Some participants do not practise homework because of trust. It takes a while for some clients to trust me, depending on their background. There may be circumstances in their life that may not allow them to trust anyone, so they are self-protective and do not have 100% trust in what you have asked them to do”…. Sharon

“One of the things mums lack is the information, if she’s been told to use medication, what are the benefits of medication, what might help, what might not help? We need this information in mum’s pack, reliable websites, and doctor’s surgery”…. Philip

However, one professional thinks that her clients tend to do their homework.
“I always teach my clients how to self-practice at home. They can use the techniques I teach them whenever they feel depressed and in most cases helps them to make changes”… **Barbra**

There appeared to be a variation in professional’s option of depressed women’s motivation to do homework or practice techniques. The combination of “always” “teach” and “changes” conveys the quality effort Barbra puts in ensuring that her clients are motivated to adhere to treatments. This is similar to Philip’s opinion in making sure that the women are aware of the purpose and benefits of using the treatments.

### 6.5.3. Theme 2: Providing multiple choice intervention

All participants stated that they used multiple of intervention. This finding was particularly striking because four of the professionals agreed that combining depends on the kind of symptoms, the state of mind or level of depression of clients. Some said that they suggested other therapies as add-ons irrespective of what has been done with their main therapy.

“I use Psycho-education and certainly use interpersonal therapy. All these are pieces of the whole pile; I don’t conform to any one modality. I kind of combine them. Some mums may sadly be engaging in drugs, alcohol or other forms of not particularly help activities, and therefore additional support will be needed” …**Barbra**

“One of the things mums lack is information. If she has been told that she has PND, what does that mean, what might cause it, what can help, what might not help, what are the benefits of medication, where can she seek help? These are the kind of information I share as additional to therapy” ….**Philip**

“Mum’s can get additional support they need from peer group and other mums who have been through PND. I something talk about these groups as helpful” …**Zain**

“In addition to CBT sessions, I give additional time for one to support and one very good thing is that a lot of women feel confident opening up about their feelings during these support sessions”…**Sharon**
These findings are consistent with the findings that women with PND have used multiple interventions to achieve greater outcome. The most common reason for combining intervention was a perception that some women require multiple kinds of therapies to be able to manage several PND symptoms and provide tailored support. However, combining several interventions for PND symptoms might be an overwhelming task for depressed women.

6.5.4. Theme 3: Noticeable effect of symptoms

The following short dialogue illustrates that for few of the professionals, there is a relationship between PND symptoms that can impact intervention outcome.

Researcher: Do you think that the soothing of one symptom would have effect on other symptom?

Professional: “Hmm… I think so. What often happens sometimes… is that the interaction between the mother and the baby, the mother and the partner, husband or other has been broken and this can affects the depressed mothers’ state of mind. So if they can manage their relationship, then there will be rapid improvement and treatment effect on other symptoms.”

For professionals, there is a belief that when one or two of the symptoms of depression is alleviated, there is a high tendency that the treatment effect other symptoms will be rapid. Furthermore, to test the hypothesis that there is no difference in intervention outcome across PND interventions professionals’ were asked about the effectiveness of the therapy they deliver to their clients. Based on the symptoms identified from the literature, all participants suggested that their intervention was either useful (4) or definitely useful (5) to alleviate PND symptoms, see figure 6.1.
Theme 4: Delivery (Flexible / Adjunct)

Professional suggests that a flexible delivery helps depressed women adhere to treatments. For some professionals, a flexible delivery option is offered as a result of built relationship and rapport the client.

“There are sometimes when I have flexible schedule for those clients that contact me to say that they are not able to meet up with our agreed time. I build a relationship with my clients and that rapport established is motivating to them to make changes and adhere”.... Barbra

“In addition to CBT sessions, I give additional time for one to support and one very good thing is that a lot of women feel confident opening up about their feelings during these support sessions”...Sharon

Barbra’s quote conveys that a flexible delivery choice and an arrangement is associated with increased adherence. For a few of the professionals a flexible delivery supports depressed women’s engagement, commitment to intervention instructions and increase moral. One of
the reason depressed women like a flexible delivery is that it allows them to fit other commitments and activities around treatment sessions such as the overwhelming responsibility of caring for infant and other children. However flexible delivery must operate to meet professionals’ availability because there might be trouble adjusting to changing appointments as explained:

“To offer flexibility can be tricky, like you might be aware that there are longer waiting times for some of these treatment sessions”....Zain

One interpretation is that Zain suggests that we have to be careful when offering flexibility as there might be other people that need to be attended to. This might be due to limited availability of human resources and time commitments are required from both the practitioner and women who can be filled with demanding responsibilities. Although it is important to note that her statement does not convey total avoidance.

6.5.5.1. Adjunct delivery

“Some mums get additional support they need from peer group and other mums who have been through PND. I something talk about these groups as helpful” ...Zain

“I kind of combine them. Some mums may sadly be engaging in drugs, alcohol or other forms of not particularly helpful activities, and therefore additional support will be needed” ...Barbra

6.5.6. Theme 5: Easy accessibility

When asked about issues that they are concerned with about the delivery of PND treatment, four respondents explain that delivery of intervention has a great impact on the outcome of the intervention. The importance of accessibility is conveyed in the interview by the fact they commented on how concerned they were about the cost and location of receiving treatment. For example, Philip’s quote articulates more about the cost and location of receiving treatment:

“Receiving treatment for postnatal depression is quite expensive for both the society and the depressed women. Some of these women have to travel long distances to get the appropriate support, and this can negatively impact their compliance”...Philip
Duration of treatment session was linked to the delivery of the intervention. Two of the professionals reported concerns regarding the treatment session timing because he thinks it is not adequate to achieve the desired outcome.

“Although, some clients required a longer period…unfortunately, there are time slots allocation for each session that does not seem to be enough but, I do not believe the duration of appointments should not hinder women from complying with their prescribed treatment”… Zain

“I have been supporting women with postnatal depression for so many and years and time is one of the greatest challenges that affect the quality of treatment.” Barbra

We identified that time was a common problem of the techniques to support PND effectively. There are two interpretations of Zain’s quote; firstly she agrees that there is limited time to attend to women. This conveys that women do not get sufficient support and this could mean that there is a need for adjunct support. Practitioners providing treatment need to have the time and skills to listen and provide tailored support to women. Secondly, she feels that the duration should not have an impact on adherence to treatment. However, this conclusion remains questionable because depressed women’s knowledge of the duration of intervention is a strong predictor of adherence (Chabrol, 2002; Ho et al., 2009; Rigbi et al., 2003; Roja, 2007; Turner et al., 2010).

6.5.7. Theme 6: Mobile application as additional support

As stated earlier interview included closed questions and participants described their view on a mobile application as additional support for the adherence to PND intervention and how useful it will be. An average was conducted, most participants showed that an adjunct mobile application would be useful for PND, see figure. 6.2.
Some of the professionals think that if the mobile app is properly checked and approved to be safe, then it will be useful to support depressed women as additional support.

“It depends on how well a mum looks at the app, but I think it will be probably useful.”

Zain

“There are some great websites and some poor ones that have not been properly checked and approved safe if it is the mobile app is properly checked then I assume it will be useful in a lot of aspects.” Philip

6.6. Discussion

Several themes have emerged from this study, and this section will contextualise those insights given the available literature. Practical recommendations for adhering to PND interventions, the strength and the weakness of the study and implication for further research will be discussed.
Participants often referred to self-management as one of the factors that influence greater PND intervention outcome. Some other participants found an association between self-management and the number of treatment sessions. This study found that participants wanted their clients to manage their wellbeing and the use of interventions after treatment sessions independently. This study suggests that support that is required for implementing and sustaining coping skills and behaviours needed to self-manage on an ongoing basis. This finding is line with studies that demonstrate that self-management is increasingly recognised as important for effective management treatment conditions (Department of Health, 2006; Powers et al., 2016). As such, this study suggests that when women are struggling to adhere to treatment self-management plan/options self-management plan should be discussed with women especially when that seem to be struggling with using interventions as prescribed.

This study confirmed the use of multiple interventions as highlighted by previous studies (Osman et al., 2014; Rojas et al., 2007; Turner et al., 2010). A growing body of research also demonstrates that the provision of additional support to prescribed treatment could enhance achieving the desired outcome and sustained effect (Broom et al., 2015). Participants reported that they provided multiple interventions due to tailored support, mother’s circumstances and needs and this influence positive treatment results. Some participants stated that additional support such as attending support groups was rewarding for both the women receiving support and those providing the support. Some other participant thought it was an opportunity to gain from someone who had ideally experienced and recovered from PND themselves. The interview suggests that because of these evaluations, these participants deemed the provision of multiple interventions as beneficial for the adherence to PND interventions. Furthermore, the noticeable effect of symptom can be linked to the findings that highlight that it was only after women got into a supportive treatment relationship and improved their communication that they were able to disclose their distress to others (McCarthy & McMahon, 2008). This finding suggests that soothing of one PND symptom lightens the effects of other symptoms.

The delivery of PND intervention emerged as an important aspect of adhering to PND interventions, largely meaning being able to provide adjunct or flexible delivery options. Participants suggested providing women with flexible or additional delivery. Particularly useful in the context of this research were women are filled with overwhelming responsibilities. There was a record of high compliance in a multicomponent intervention that was supported by regular phone calls from trained mental health workers, in this study depressed women were constantly reminded about the need for taking medications as prescribed in sessions (Rojas et al., 2007). Studies that provided facilities for infant care as additional delivery option reported a higher level of compliance to treatment (Honey, Bennett, & Morgan, 2002; Reay et
al., 2006). Indeed, participants in this study advised that flexible or adjunct intervention delivery option is helpful for improved treatment adherence.

Participants described easy accessibility as an important factor for adherence to the intervention. The duration of the treatment session, the cost of receiving treatment including struggles with travelling, location and waiting times were all highlighted as key to improved adherence. Studies have documented the inability of women to attend regularly scheduled appointments due to the treatment location (Goodman, 2009; O'Mahen et al., 2014). Home-based interventions have reported increased treatment outcome with no drop-outs from therapy occurring (Chabrol, et al., 2002). This is largely due to the convenient location of receiving treatment. Studies have suggested that the burden of depression is reflected in depression-related costs (Gerhards et al., 2010). Accessibility factors might, therefore, be helpful to consider when providing intervention adherence measures. Furthermore, the strong reaction toward the availability of a mobile application as additional support to PND treatment across the interview suggests that adjunct support is of great importance or that participants have a desirable attitude towards additional findings. However, some participants suggest that the mobile application is checked as a suitable tool to help change and facilitate the adherence behaviour in women with PND depressed.

The researcher aimed to remain steadfast as possible to the words of the participants and greater part of the findings are in line with the previous literature. In any case, by IPA’s methodological requirements, the translations are personal conclusions based on the researcher’s perspective and knowledge. The key strength of this study lies in its respect of the practitioner’s views afforded by the methodology used which allowed combining data collection strategy and in-depth opinion. Generalisation of the findings are conceivable simply after various examinations have been created and, because this is not the situation for this investigation, its generalizability stays restricted.

6.7. Conclusion

The practitioners in this study represented a group of participants who provide treatment for women with PND. Six core themes were identified in the analysis of these practitioners opinion on techniques and factors that influence greater PND intervention results and the use of an adjunct mobile application to change and facilitate the adherence behaviour. It is clear that self-management is an important factor that may facilitate the adherence behaviour and majority of the practitioners emphasised on women taking control of their prescribed
treatments. Thus, we conclude from the data that self-management is an important factor to facilitate adherence and improved PND treatment results. The use of multiple interventions was apparent as a method of achieving improved wellbeing for women with PND. Hence, the second statement was developed: The option to combine multiple interventions should be encouraged for tailored treatment outcome. It was suggested that when the effect of a treatment is noticeable the effect of other symptoms are relieved. This also means that when women can notice the effect of treatment, it builds a positive attitude toward treatment adherence. Therefore, we suggest that techniques that will make treatment effect on symptoms noticeable be discussed or provided because it could help control the adherence behaviour. Furthermore, one barrier to seeking treatment was linked to trust and fear. This means that women need to be confident that they are receiving the required care and are able to engage with treatment effectively. Practitioners also mentioned the requirement of easy accessibility as an important factor that facilitates adherence. Therefore, we recommend a flexible, adjunct platform that will facilitate confidentiality and privacy as well as encourage easy accessibility and increased engagement with treatment technique when required.

While this study is informative about the factor that can facilitate adherence to PND interventions, further studies such as this one could yield a more complete and solid picture of practitioner view on factors that can facilitate the adherence behaviour and the use of additional support for PND and perhaps a larger sample size.
7. Adherence Behavioural Change Wheel

7.1. Introduction

In this thesis, we capitalise on the understanding of women’s beliefs, and the knowledge and skills of practitioners for improving PND treatment adherence and sustained outcome. One of our primary goals is to design a tool that is based on factors that inhibit non-adherence to prescribed PND interventions. It is, however, not anticipated that the proposed adherence framework will replace other measures, but is aimed to complement existing compliance strategies.

Incorporating good design principles early and throughout the development lifecycle gives rise to systems that are easy to learn, increase user productivity and satisfaction, increase user acceptance, decrease user errors, and decrease user training time (Johnson, Johnson, & Zhang, 2005). The idea of understanding user needs and goals through User Centred Design (UCD) has attracted growing interest (Duarte & Guerra, 2012). One of the purposes of this research is to create a mobile application that is modelled on the characteristics and needs of the users. In applying a UCD approach, studies in chapter five and six of this thesis were conducted to elicit women beliefs and practitioners views and approach to facilitating adherence to PND interventions. This led to the development of a treatment adherence framework and the proposed mobile application pulled together different elements from this tool. Each of the elements of the ABC-W produces knowledge that could enable us to envision various activities and features with the potential to be developed through different technical support tools.

We identified that women might unintentionally not adhere to treatments due to barriers or problems that prevent them. Applying a UCD approach, it is important to identify the user characteristics of the proposed adherence framework. In chapter five and six of this thesis, we identified women’s behavioural beliefs and factors that may impede adherence. We further elicited the perception of practitioners on the PND interventions. Data from these studies provided invaluable insights into variables that could potentially influence PND treatment adherence. Based on this premise, we developed an Adherence Behavioural Change Wheel (ABC-W). ABC-W has the potential to provide useful guidance to assist women and practitioners in creating effective treatment adherence behavioural change. Treatment adherence behavioural change is achieved by evaluating the variables which can have an impact on adhering to
prescribed treatments. The next section gives a picture of the flow of the design process and examines the constructs of the ABC-W and how it could potentially help create an effective treatment adherence behavioural change.

7.2. Overview of the Adherence Behavioural Change Wheel

The ABC-W will serve as a framework that is used to identify and address women’s behavioural, control beliefs and the perception of significant others about PND interventions. It also has the potential to bridge the gap between the intention to adhere to treatment and volitional control. ABC-W is useful because it will facilitate a shared decision-making environment. More importantly, women with PND may not have the insight to generate a useful adherence behaviour change solution independently. This tool includes a four-layered approach to identifying adherence factors and facilitating change. Practitioners will involve women in the discussion while spinning between the ABC-W variables. Engaging with ABC-W will facilitate the discussion between the practitioner and women on what they need to do differently when, where and how. Thus, enabling the clarification of concerns and support users in making decisions about how to adhere to treatment. The users will need to match up different ABC-W constructs, ask and answer questions that might cause non-adherence using the provided factors. In combination the ABC-W constructs are linked such that they can influence one another, this could potentially lead to women’s change in treatment adherence behaviour.
Figure 7.1: Adherence Behavioural Change Wheel

Table 7.1: ABC-W Guidelines

<table>
<thead>
<tr>
<th>Possible questions to ask about</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Intervention</td>
</tr>
<tr>
<td>• Knowledge about the intervention</td>
</tr>
<tr>
<td>• Beliefs</td>
</tr>
<tr>
<td>• Awareness of the effect of non-adherence on treatment</td>
</tr>
<tr>
<td>• Familiarity with the effect of non-adherence</td>
</tr>
<tr>
<td>• Delivery</td>
</tr>
<tr>
<td>• Thoughts on intervention delivery</td>
</tr>
<tr>
<td>• Concerns that might be associated with delivery</td>
</tr>
<tr>
<td>• Thoughts on the delivery in the long-term</td>
</tr>
<tr>
<td>• Symptoms</td>
</tr>
<tr>
<td>• Specific treatment adaptation</td>
</tr>
<tr>
<td>• Effects of symptoms</td>
</tr>
<tr>
<td>• Multiple interventions</td>
</tr>
<tr>
<td>• Additional intervention</td>
</tr>
<tr>
<td>• Control over managing multiple interventions</td>
</tr>
</tbody>
</table>
Instructions: Work with the clients to conceptualise diverse ways to approach the subject of discussion. Pick an alternative approach that is both practical and has a high
probability of happening. Practice it, and after that have the clients give it a go. If any response suggests a problem, it is essential to develop an individual adherence plan.

7.2.1. Adherence Behavioural Change Wheel process

The process starts by identifying and understanding the three constructs, the prescribed interventions, beliefs about the interventions and intervention delivery options. These set out a generalised discussion of the behavioural factors. A focus on each of these constructs will lead to wheeling around the second layer which includes women’s perspective on symptoms, multiple interventions, adjunct support and flexible delivery. The outcomes of these are further synthesized and rotated around the accessibility factors, waiting times, cost of receiving treatments, session duration and treatment location. The outside layer which is the self-monitoring, self-incentives and specific plans provide a bridge between the behavioural intention and the likelihood of performing the actual behaviour.

It is important to note that discussions on ABC-W variables should be explored in an open and non-judgmental manner and involves dialogue between the layers. The general sequence for ABC-W is as follows:

- Identify that a woman’s adherence behaviour needs to change.
- Discuss each element that could have an impact on adherence.
- Wheel variables around the different layers.
- Carryout each stage of the wheel, ensuring that they are matched with one another.
- Decide how adherence will be ensured.

In the next section, the variables of the ABC-W will be discussed.

7.2.1.1. Behavioural factors

To develop a PND adherence change measure, the behavioural factors must be considered throughout the development process (I Ajzen, 2011). For the ABC-W, the behavioural factors include three variables, interventions, beliefs and delivery. Discussing these variables will provide a broad yet precise initial understanding of the
factors that may influence adherence to the prescribed PND treatments. It is essential that this could help to look at the right problems and offer a clear guide to identifying adherence factors that need to change.

7.2.1.2. Intervention

As the purpose of this study is to develop a framework that could facilitate treatment adherence, initially the prescribed intervention must be defined regarding its purpose, benefits, effects and knowledge. A conversation on the intervention is important to explore their views, fears and experiences about the prescribed intervention (Grimes & Barnett, 2014; Omisade, Good, Fitch, & Briggs, 2017). This will provide an understanding of the kind of treatment required for their specific treatment-related needs (Dennis & Chung-Lee, 2006; Goodman, 2009; O’Mahen et al., 2014).

7.2.1.3. Beliefs

The beliefs include an understanding of women’s perspective about the consequences of non-adherence and engaging in this discussions could facilitate an outline of their thoughts and decision to adhere to treatment. Sometimes it is difficult to understand why a depressed woman resolves to use their prescribed treatment in a certain way, or not to use them at all. However, by considering the women’s perspective, you will be taking a user-centred approach and contribute to the formation of increase adherence using the right thoughts (Grimes & Barnett, 2014; Omisade et al., 2017).

7.2.1.4. Delivery

The delivery of treatment is critical when addressing non-adherence to treatment. Several studies have indicated that intervention delivery can influence improved adherence (McCarthy & McMahon, 2008; Morrell et al., 2009; Omisade et al., 2017; Rojas et al., 2007; Turner et al., 2010). The aim of discussing the method of delivery is to uncover delivery concerns that might be associated with adherence. Associating the delivery with other variables of the framework may further give an important clue on the direction and factors that need to be targeted.
7.2.1.5. Adherence factors

Engaging women in a discussion on adherence factors could define and identify the associated factors causing non-adherence to prescribed interventions. It could also increase their recognition of the detrimental effect which can result from non-adherence (Klier et al., 2001). Once there is a list of variables that could relate to non-adherence, users can then decide on which factor they need to focus on. In our studies, we identified some common factors that could influence non-adherence (Omisade et al., 2017). Subsequently, it is required that users will need to specify which one of the factors that could have an impact on non-adherence. This can be whirled around with the accessibility factor layer and implementation option layer to form a rich picture of what needs to change and how to change it.

7.2.1.6. Symptoms

One primary factor that affects increase adherence to prescribed treatment is the symptoms of PND (Armstrong, Phys, & Bed, 2004; Milgrom et al., 2011; Omisade et al., 2017). The aim of discussing the perspectives on symptoms is because research has identified that women suffering from PND required specific treatment adaptation due to varying symptoms (O’Mahen et al., 2014). This is confirmed in chapter five, which identified that different interventions have different levels of effect on PND symptoms. It is therefore suggested that symptoms be discussed and matched against other variables of the wheel to further identify the adherence factors.

7.2.1.7. Multiple interventions

Findings from chapter five and six recommended that, rather than providing women with a single intervention for all PND symptoms, there should be a multiple choice option that is open to adapting support to depressed women’s specific needs (Omisade et al., 2017). This has the potential to give them the opportunity to have control over their desired intervention outcome. Therefore it is fundamental that the option to combine multiple interventions should also be discussed with women.
7.2.1.8. Adjunct support

Adjunct treatment needs to remain available to women receiving the intervention, both during and after the intervention has ended (Milgrom et al., 2011; Turner et al., 2010). The effect of adjunct support was revealed in several studies (Omisade et al., 2017; Rojas et al., 2007). Adherence is not simple to achieve, so the role of adjunct support is to ensure increased adherence. Having a conversion on adjunct support is considered as important to providing quality support and increased adherence. It could also encourage increased engagement with treatment technique when required (Honey et al., 2002; Omisade et al., 2017; Reay et al., 2006; Rojas et al., 2007).

7.2.1.9. Flexible delivery

A flexible delivery option rose as a crucial part of adhering to prescribed treatments (Klier et al., 2001; O’Mahen et al., 2015; Powers et al., 2016; Slade et al., 2010). This is particularly useful because women with PND are filled with overwhelming responsibilities and are unable to fit the delivery sessions into their schedules. It could also potentially help women adjust to mothering difficulties they go through (Klier et al., 2001; Reay et al., 2006). It is therefore recommended that the flexible delivery option should be considered as it could indicate if there would be a need for additional support to enhanced delivery (O’Mahen et al., 2014; Omisade et al., 2017; Rojas et al., 2007).

7.2.1.10. Accessibility factors

When developing intervention adherence measures, it is essential to consider the factors that could be associated with non-adherence. The findings from this research suggested that easy accessibility to PND interventions is necessary and must be clearly defined when developing compliance measures (Omisade et al., 2017). Identifying and breaking down treatment accessibility factors into specific and manageable solutions may likely influence the ability for women to manage barriers and act on that recognition by planning alternative options (Powers et al., 2016). It is therefore important to discuss accessibility factors and match them up with adherence and behavioural factors because it might provide guidance when developing treatment adherence measures.
7.2.1.11. Waiting times

The waiting times should be considered for the behavioural and adherence factors as this might have an adverse effect on adherence (O'Mahen et al., 2014; Omisade et al., 2017). This should result in a set of specific times schedules that are available of can be provided. This element aims to prepare women for making alternate plans that may result from inconvenient waiting times.

7.2.1.12. Cost

It is important to direct adherence measure to those women who are experiencing difficulties with the cost of receiving treatments. Importantly, women have expressed concerns about the cost of receiving treatments and this has been associated with adherence (Omisade et al., 2017). Therefore, this element could help identify aspects of intervention that would require more support due to the cost of receiving treatments.

7.2.1.13. Appointment duration

The duration of each appoint could have a negative effect on adherence especially taking into consideration that variable infant feeding and napping schedules can interfere with appointments (Goodman, 2009; O'Mahen et al., 2014; Rojas et al., 2007; Turner et al., 2010). Considering the duration of each appointment could point out to practitioners if individuals struggle and this may further help to clarify if the women require adjustments.

7.2.1.14. Treatment location

Women have reported struggles with the location of receiving treatments (Chabrol et al., 2002; Reay et al., 2006). Therefore, exploring the perception of the treatment location could help make an informed decision for both the practitioner and the woman with PND. This could involve discussing the impact the location can have on adhering to prescribed treatment, session duration, waiting times or other variables of the framework.
7.2.1.15. Implementation options

Intentions that are made salient by a broad range of situations or intentions that could be acted on in a variety of different ways are unlikely to result in action initiation (Orbeil, Hodgdns, & Sheeran, 1997). The concept of implementation intentions is rooted in self-regulation theory, and this is concerned with how people plan to overcome anticipated problems en route to goal achievement, given that they are committed to a certain goal (Rise, Thompson, & Verplanken, 2003). Some empirical studies attest to the utility of forming implementation intentions in the process of translating a behavioural (or goal) intention into actual behavioural performance (or goal achievement) (Gollwitzer, 1999; Rise et al., 2003).

An implementation intention is one possible way of delivering behavioural change techniques is to ensure that people act in certain ways (Gollwitzer, 1999). This is a crucial link between the behavioural, adherence and accessibility factors because it gives concrete and precise plans on how to implement the adherence behaviour. We know that they are very specific because if you ask people to make plans, they don't work, whereas if you get people to form implementation intentions, we find that it consistently brings about significant sustained changes in behaviour. Providing implementation intentions with women can give an understanding of how to overcome unexpected obstacles as well as linking critical situation with appropriate responses. The implementation options for ABC-W are outlined below.

7.2.1.16. Self-monitoring

Self-monitoring is potentially required for implementing and sustaining coping skills and behaviour on an ongoing basis (Powers et al., 2016). Self-monitoring appears consistently to be an effective behavioural change technique that seems to work across lots of different kinds of the domain (Olander et al., 2013). Self-monitoring could potentially be used to monitor the treatment progress, treatment patterns, identify the effect of the intervention on symptoms or help determine what factor should be the focus of increased adherence. This should strengthen the underlying process through which implementation intention change behaviour (Prestwich, Perugini, & Hurling, 2010).
7.2.1.17. Self-incentives

Self-incentives can play an important role in increasing adherence and get people to reward themselves could stimulate a positive cycle of change. Encouraging people to self-incentivise (i.e., to reward themselves in the future if they are successful in changing their behavior) or self-reward (i.e., prompt people to reward themselves once they have successfully changed their behavior) are techniques that are frequently embedded within complex behavior change interventions (Brown, Smith, Epton, & Armitage, 2017; Kobayashi, Osanai, Sado, Naruse, & Horiguchi, 2017; Michie et al., 2013; Payne et al., 2015). With self-incentives, women could overcome problems like procrastination and has the potentials of making women energised, cared for, contented, which boost self-command.

7.2.1.18. Specific plans

According to research specifications, a structured support plan is viewed as a behavioural control tool, critical for achieving increased treatment understanding, self-management and adherence (Powers et al., 2016). This might be more effective when two people form plans and subsequently perform the behaviour (Prestwich et al., 2010). Specific plans could help initiate behaviour change by highlighting the opportunities to act. Specific plans could include providing self-completion instructions, solutions or appropriate responses to critical situations.

7.3. Conclusion

This chapter gives an overview of the ABC-W treatment adherence framework. This tool was built from behavioural beliefs and factors that may impede adherence (chapter 5 and 6). It has incorporated factors that have the potentials to impact and facilitate adhering to PND interventions. This framework will be utilised when implementing the adjunct mobile application for PND. Future research should investigate the effectiveness of the intervention on women with current episodes of PND. Furthermore, there is potential for utilising the ABC-W in the treatment of other categories of treatment adherence.
8. Conceptualizing the functional requirements of an adjunct mobile application from the Adherence Behavioural Change Wheel.

8.1. Introduction

In chapter 7 we examined the constructs of the ABC-W and how it could potentially help create an effective treatment adherence behavioural change. This chapter provides a detailed description and rationale for a set of functional requirements for an adjunct mobile application that could help to facilitate adherence to prescribed PND treatments. These requirements draw upon the ABC-W framework which based on a User Centred Design (UCD) and has the potentials to aid women with PND to adhere to treatments. A prototype mobile application will be developed based on a set of functionalities and requirements derived from the ABC-W framework. The purpose of the prototype is to demonstrate the reasoning behind the functionalities and overall concept of the ABC-W framework as a vehicle to gain feedback from PND professional before further research is carried out. However, it is crucial ensure that the mobile application is usable and can be evaluated against the developed functionalities and requirements, which can be seen in chapter 10. This study used a scenario-based approach to inform the development of the mobile application functionality and requirement gathering process. It is important to acknowledge that the analysis described in this study were obtained in a preliminary usability phase. The usability requirements would not end at this initial step but will continue to occur incrementally in future fully integrated studies.

The People At the Centre of Mobile Application Development (PACMAD) usability model identifies three factors which can affect the overall usability of a mobile application: User, Task and Context of use (Harrison, Flood, & Duce, 2013; Walker, Stanley, & Lindsay, 2005). Similarly, Nielsen (1994) also recognise these factors as being critical to the successful usability of software. The next section gives an overview of the user analysis, environmental analysis, and task analysis considered for the design and development of the mobile application prototype. Each of these analyses can be dynamic and provides different, but necessary components to design the initial prototype of the proposed mobile application.
8.2. Preliminary user analysis

One of the most significant issues in the design of usable applications is to learn about the people who will be using the app (Doherty, Coyle, & Matthews, 2010; Duarte & Guerra, 2012). User analysis consists of examining the characteristics of the intended users. Since the focus of the research is to provide an adherence support for women with PND, users are categorised as women suffering from PND. It is assumed that women with PND of all educational levels, ages and social classes are already familiar with mobile phone and applications (Zhang, Zhang, Wang, Yang, & Zhao, 2017). Results from our study provided information that women have access to a mobile phone and are happy to use an adherence mobile application as additional support (see 5.1.12). Therefore supporting women to adhere to intervention via a mobile application does not involve the introduction of an unfamiliar or an intrusive tool. Although it is identified that physical characteristics, cognitive and perceptual abilities, personalities and abilities of women with PND are essential. This is beyond the scope of this research but is considered briefly in chapter nine of this thesis.

8.3. Preliminary environmental analysis

As discussed in chapter two 2.4, that many depressed women even when there are effective intervention delivery options remain without treatment or poorly comply due to perceived stigma (O'Mahen et al., 2014). The proposed application would be used in private and developed so that users can have control of their privacy and confidentiality which might reduce the embarrassment that might be experienced in face-to-face interaction and thus encourage self-disclosure (Doherty et al., 2010; Holtz et al., 2017). The just-in-time mobile app can be used anywhere and at any time. The overwhelming responsibilities and busy schedules of women were significant to consider because it could affect the use of the proposed system. Furthermore, we believed that women might be faced with problems of intervention accessibility such as location, duration, cost and waiting time that can have an impact of women with PND (Omisade et al., 2017; Zhang et al., 2017). The system was therefore designed to consider these factors by allowing users to monitors and manage accessibility factors as described in chapter five of this thesis.
8.4. Preliminary task analysis

The task is often what provides the catalyst for developing a particular system. The task analysis examines the goals of the user, the required functionalities of the proposed mobile application (Johnson et al., 2005). Task analysis describes the way problems will be solved. User task includes what, how and when task is done. The purpose of the mobile application is to facilitate women to adhere to prescribed treatment. This will include several tasks such as helping women to manage and monitor the use of multiple interventions. This will focus on allowing users to save, edit and delete details of prescribed interventions. It will also serve as an environment were women can keep a record and manage the impact of symptoms so that changes are noticeable. Furthermore, they can keep records of prescription instructions and provide positive prompts to users for better communication as well as keep a record of scheduled treatments appointment duration. The mobile application will facilitate prompts and reminders as a means of self-guidance, give self-incentives and save specific plans. It will also help women stay in contact with healthcare providers, family and friends when further guidance or help is needed. Moreover, the women may switch or alternate task, or complete multiple simultaneous tasks in the mobile application.

When examining some of the tasks more closely, some of them that seemed simple may turn out to be composed of a significant number of important subtasks. Hierarchical Task Analysis (HTA) is a common approach carried out with the target of achieving both goals and sub-goals of a system through the expression of physical and cognitive operations (Bin, Azlis-Sani, Yunos, Ismail, & Tajedi, 2016). HTA provides a detailed description of the goal, and it is often used to reduce error and assist for further in-depth analysis. The HTA for this study is described as shown in Figure 8.1. There are four steps on level one, and these can be categorised as a primary goal, and this could be further broken down into level two to provide a better understanding regarding the goal. It could be subdivided into several sub-goals in achieving and completing the main goal. This involved answers to the following specific questions:

- What actions/goal has to be performed?
- What element is involved?
- What tools have to be used to perform the goal?
- What purpose does the sub-goal serve?
- Is this sub-goal necessary?
• When and how often do specific goal have to be performed?

Answers to these questions reveal all the goals involved in the mobile application. It further showed goals involving similar actions and these were combined. It also helped to identify a task that could be performed at the same time, and this was restructured.

![Diagram of HTA of an adherence mobile application]

**Figure 8.1: HTA of an adherence mobile application**

### 8.5. Functional requirements of the mobile application prototype

To establish a rich picture, we conceptualise the system via a scenario and to elicit a list of functional requirements from the proposed scenarios that direct the design and development process. Scenarios, as described, are used to represent a sequence of events or tasks and are frequently applied to support User Centred Design (Vincent & Blandford, 2015). The process of requirements elicitation is depicted is a link between the framework, scenario and requirements. The scenario template includes elements of the ABC-W (Multiple interventions, Symptoms, Accessibility factors, Self-monitoring, Self-incentives and specific plans). Using the template, a scenario was envisioned
describing a woman with PND and the activities that could be provided to facilitate adherence to prescribed interventions via a mobile application.

The scenario development encouraged the design to be both imaginative and realistic. Activities and functions that are supported by the scenario are abstracted out and presented as general requirements that direct the design and development of the adherence mobile application environment. Each requirement is put in the Volere shell to provide a detailed description (Robertson & Robertson, 2003). The Volere shell tool ensures that requirements are collected accurately, consistency and compatibility in a clear and simple format. It affords traceability in where a requirement originates and where it appears in later documentation such as use cases. This was used to adapt the requirements as a basis for discovering, organising, track a huge amount of requirements emerging from elicitation process, communicating the requirements in addition to saving time.

Figure 8.2: The Volere shell used for requirements (Robertson & Robertson, 2003. p. 5)

To provide a practical account and reasoning for the development of scenarios and requirements, we provide the processes that carried out.
8.5.1. Development of the scenario template

This section details the scenario with a detailed description of their elements presented in the scenario template.

Table 8.1: Scenario template: Adhering to prescribed PND treatment using a mobile application

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users characteristics</td>
<td>A new mother suffering from postnatal depression</td>
</tr>
<tr>
<td>Approach to adhering to</td>
<td>Using the intervention adherence mobile application</td>
</tr>
<tr>
<td>prescribed treatment</td>
<td></td>
</tr>
<tr>
<td>Problems and obstacles</td>
<td>Inability to manage multiple interventions</td>
</tr>
<tr>
<td></td>
<td>Missing prescribed treatments</td>
</tr>
<tr>
<td></td>
<td>No record of treatment instructions, dosages and appointments plans</td>
</tr>
<tr>
<td></td>
<td>Inability to ask for help</td>
</tr>
<tr>
<td></td>
<td>Failure to self-monitor prescribe treatment</td>
</tr>
<tr>
<td></td>
<td>Appointment scheduling</td>
</tr>
<tr>
<td>Technology used</td>
<td>Mobile phone, Mobile application</td>
</tr>
<tr>
<td>Approach to ensuring adherence</td>
<td>Using the adherence mobile application</td>
</tr>
<tr>
<td>Intervention / future idea</td>
<td>Mobile application accessibility, learnability, memorability, errors,</td>
</tr>
<tr>
<td></td>
<td>satisfaction</td>
</tr>
</tbody>
</table>

8.5.2. Description of the scenario narratives

This section describes the scenario developed in line with the template discussed above.

8.5.2.1. Usage scenario

Hannah is a mother of four children suffering from postnatal depression. She has an appointment with the therapist. The therapist has prescribed some antidepressants to her. She is very positive about recovering quickly and tried to adhere to prescribed treatments by using an adherence mobile application. She picked up her mobile application and recorded the instructions and usage of the prescribed medication. The
therapist has also suggested some CBT techniques to her which she saved on her mobile application.

School term-times are very stressful for Hannah; she has to wake up very early to get herself and the kids ready for work and school respectively. She is required to use her antidepressant at 8:30 am every morning which is 10 minutes before she leaves the house with the kids. She keeps forgetting to use her prescribed antidepressant before she leaves the house, but the mobile application alert activates at 8.25am to remind her of the medication. On one occasion her newborn was crying nonstop, and she missed her medication dosage that morning. However, the mobile application was able to remind her that she missed the dose but she can practice the CBT technique later in the day.

Hannah was on her way to her six weeks checkup. Unfortunately, there was a terrible traffic jam on the highway, and there was no way out. Her appointment was in fifteen minutes; there was no way to anticipate this tie-up. Unfortunately, she missed her appointment, and she has to wait for another six weeks for a time slot. The mobile application notification activates and updates her on the appointment. The mobile application suggests that she rewards herself if she is at her appointment or not to worry if she missed it, she can continue using her antidepressants before she gets another appointment booked. As soon as she gets home, she calls her therapist to inform her of the situation and to book another appointment. She picks up her mobile application and records her next appointments. She added notes and notifications to remind her to prepare for unforeseen circumstances such as traffic. She has also saved the session duration, location and cost of travel for that appointments. She added a reminder to notify her of this information one week before her next appointment.

In addition, Hannah has had a very hectic week, and by sending an automated message via the mobile application, she was able to ask for support from her mother. She had previously invited to join her mobile application profile to monitor her compliance with her prescribed treatment. She is fast asleep while her mum is taking care of the kids. Her mother was able to view how compliant she had been with using her medication and practising her CBT techniques. She was also able to see the improvements in PND symptoms that Hannah had recorded. Hannah's mum was
impressed and promised to come to have the kids for the weekend as an incentive for increased compliance to treatment. Hannah accepted that as her treat for the week.

8.6. Functional requirements in the Volere Shell

This section of the requirements development was to abstract out typical activities that are envisioned through our scenario (see table 8.2). The narrative scenario was analysed, and activities that the mobile application should support were identified. These are presented as a list of functional requirements. We provide a detailed description and rationale for each requirements using the Volere shell (see table 8.3, 8.4, 8.5, 8.6) (Robertson & Robertson, 2003). These requirements are as follows:

- **R 1.** Manage and monitor the use of multiple interventions
- **R 2.** Manage the impact of symptoms so that changes are noticeable
- **R 3.** Record prescription instructions and prompts increased self-monitoring
- **R 4.** Self-incentives and just-in-time support
Table 8.2: Abstracting out activities from scenario

<table>
<thead>
<tr>
<th>Requirements (R)</th>
<th>Scenario’s activity</th>
<th>Abstracting out common activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1: <em>Manage and monitor the use of multiple interventions</em></td>
<td>Hannah is a mother of four children suffering from postnatal depression. She has an appointment with the therapist, and he has prescribed some antidepressants to her. She is very positive about recovering quickly and tried to adhere to prescribed treatments by using an adherence mobile application. She picked up her mobile application and recorded the instructions and usage of the prescribed treatment. The therapist has also suggested some CBT techniques to her which she saved on her mobile application.</td>
<td>Users will want to manage the use of multiple interventions and may wish to keep records of usage. They may also want to keep a record of treatments dosage and instructions.</td>
</tr>
<tr>
<td>R2: <em>Manage the impact of symptoms so that changes are noticeable</em></td>
<td>School term-times are very stressful for Hannah; she has to wake up very early to get herself and the kids for work and school respectively. She is required to use her antidepressant at 8:30 am every morning which is 10 minutes before she leaves the house with the kids. She keeps forgetting to use her prescribed antidepressant before she leaves the house, but her alarm rings at 8:25 am to remind her of the medication. On one occasion her newborn was crying nonstop, and she missed her medication dosage that morning. However, the mobile application was able to remind her that she missed the dose but she can practice the CBT technique later in the day.</td>
<td>Users will require prompts for prescribes treatment use and remind them of an alternative when they miss any treatment. They will also appreciate reminders and comforting notifications.</td>
</tr>
<tr>
<td>R3: <em>Record prescription instructions and prompts increased self-monitoring</em></td>
<td>Hannah was on her way to her six weeks checkup. Unfortunately, there was a terrible traffic jam on the highway, and there was no way out. Her appointment was in fifteen minutes; there was no way to anticipate this tie-up. Unfortunately, she missed her appointment.</td>
<td>The user will appreciate having specific plans such as keeping a record of appointment schedules as</td>
</tr>
</tbody>
</table>
appointment, and she has to wait for another six weeks for a time slot. The mobile application notification activates and updates her on the appointment. The mobile application suggests that she rewards herself if she is at her appointment or not to worry if she missed it, she can continue using her antidepressants before she gets another appointment booked. As soon as she gets home, she calls her therapist to inform her of the situation and to book another appointment. She picks up her mobile application and records her next appointments. She added notes and notifications to remind her to prepare for unforeseen circumstances such as traffic. She has also saved the session duration, location and cost of travel for that appointment. She added a reminder to notify her of this information one week before her next appointment.

| R4: Self-incentives and just-in-time support | Hannah has had a very hectic week, and by sending an automated message via the mobile application, she was able to ask for support from her mother. She had previously invited to join her mobile application profile to monitor her compliance with her prescribed treatment. She is fast asleep while her mum is taking care of the kids. Her mother was able to view how compliant she had been with using her medication and practising her CBT techniques. She was also able to see the improvements in PND symptoms that Hannah had recorded. Hannah’s mum was impressed and promised to come to have the kids for the weekend as an incentive for increasing compliance to treatment. Hannah accepted that as her treat for the week. | The user will want to be able to seek support. They will want to add other people to view their profile to monitor their adherence. The users will also want to give self-incentives and award themselves for being compliant. |
Table 8.3: Requirement one in Volere Shell

<table>
<thead>
<tr>
<th>Requirement Number</th>
<th>R1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Manage and monitor the use of multiple interventions</td>
</tr>
<tr>
<td>Requirement Type</td>
<td>Functional</td>
</tr>
<tr>
<td>Event / Use case</td>
<td>Scenario</td>
</tr>
<tr>
<td>Description</td>
<td>The mobile application should provide the facility to manage and monitor user’s prescribed interventions.</td>
</tr>
<tr>
<td>Rationale</td>
<td>Different interventions have a distinctive level of effect on PND symptoms. The option to record multiple prescribed interventions could provide adaption to women’s specific needs such as using different interventions for different symptoms. This should give women the opportunity to have more control over their desired intervention outcome.</td>
</tr>
<tr>
<td>Originator</td>
<td>Qualitative and Quantitative studies</td>
</tr>
<tr>
<td>Fit Criterion</td>
<td>This requirement will be fulfilled once the system can accept user inputs, edit and delete their prescribed treatments</td>
</tr>
<tr>
<td>Supporting material</td>
<td>Chapter 5,6 and 7</td>
</tr>
</tbody>
</table>

Table 8.4: Requirement two in Volere Shell

<table>
<thead>
<tr>
<th>Requirement Number</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Manage the impact of symptoms so that changes are noticeable</td>
</tr>
<tr>
<td>Requirement Type</td>
<td>General</td>
</tr>
<tr>
<td>Event / Use case</td>
<td>Scenario</td>
</tr>
<tr>
<td>Description</td>
<td>The application should provide facility to reflect relief in symptoms.</td>
</tr>
<tr>
<td>Rationale</td>
<td>The soothing of one symptom factor alleviates the effects of other symptoms. For example, it was only after women got into a supportive treatment relationship and improved their communication that they felt able to disclose their distress</td>
</tr>
</tbody>
</table>
to others. The option to make the effect of symptoms evident might help ease the effect of other symptoms.

**Originator**
Qualitative and Quantitative studies

**Fit Criterion**
This requirement will be fulfilled once the system can allow users to record the effects of prescribed interventions on symptoms

**Supporting material**
Chapter 5, 6 and 7

---

**Table 8.5: Requirement three in Volere Shell**

<table>
<thead>
<tr>
<th>Requirement Number</th>
<th>R3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
<td>Record prescription instructions and provide positive prompts to users for better communication and self-guidance</td>
</tr>
<tr>
<td><strong>Requirement Type</strong></td>
<td>General</td>
</tr>
<tr>
<td><strong>Event / Use case</strong></td>
<td>Scenario</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>The application should allow the user to record prescription instructions and be designed to record prompt notification. The app should further enable users to create specific plans and give self-incentives</td>
</tr>
<tr>
<td><strong>Rationale</strong></td>
<td>A structured support plan is viewed as a behavioural control tool, critical for achieving increased treatment understanding, self-management and adherence. TPB theorists propose that intentions to perform a behaviour will more likely translate into behaviour when implementation intentions are garnered (Orbeil et al., 1997; Sheeran, Milne, Webb, &amp; Gollwitzer, 2005; Vallance, Courneya, Taylor, Plotnikoff, &amp; Mackey, 2008). The study identified the need to bridge the gap between motivation and volition. This is supported by the Theory of Implementation Intention (TII). TII is one possible means of delivering behaviour change techniques. Implementation intentions are very specific type of plans; we know this to be the case because, if you just ask people to make plans they do not work, whereas if you get people to form implementation intentions we find that it</td>
</tr>
</tbody>
</table>
consistently brings about significant sustained change in people’s behaviour (Sheeran et al., 2005). TII proposes that successful behaviour change is facilitated by furnishing the intention with an ‘if-then’ plan specifying when, where and how the individual will achieve the behaviour (Sheeran et al., 2005)

**Originator**
Qualitative and Quantitative studies

**Fit Criterion**
This requirement will be satisfied once the system allows the user to record prescribed treatment instructions and present notifications and reminders. Users should be able to record the treatment location, duration, cost and waiting times.

**Supporting material**
Chapter 5, 6 and 7

---

**Table 8.6: Requirement four in Volere Shell**

<table>
<thead>
<tr>
<th>Requirement Number</th>
<th>R4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
<td>Self-incentives, specific plans and just-in-time support</td>
</tr>
<tr>
<td><strong>Requirement Type</strong></td>
<td>General</td>
</tr>
<tr>
<td><strong>Event / Use case</strong></td>
<td>Scenario</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>The application should be designed to allow users to record detailed plans and communicate with their healthcare providers or family when they require additional help or support.</td>
</tr>
<tr>
<td><strong>Rationale</strong></td>
<td>Receiving social support through friends and relatives during stressful times is thought to be a protective factor against depression and several earlier studies have evaluated the role of social support in reducing postpartum depression (Robertson, Celasun, &amp; Stewart, 2003). Recognising thoughts and replacing them with realistic and positive ones help break the negative thought circle. Several reports state that purely self-guided interventions do benefit depressed individuals, but further gains are achieved with guided support (Andersson &amp; Cuijpers, 2009; Spek et al., 2007). Women with PND are associated with</td>
</tr>
</tbody>
</table>
higher level of dysfunctional, thus will require greater need for control of self (L. Jones et al., 2010).

<table>
<thead>
<tr>
<th>Originator</th>
<th>Qualitative and Quantitative studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit Criterion</td>
<td>This requirement will be fulfilled once the system allows the user to invite family to monitor their treatment usage as well as send alerts and reminders to them when they need help.</td>
</tr>
<tr>
<td>Supporting material</td>
<td>Chapter 5, 6 and 7</td>
</tr>
</tbody>
</table>

8.7. Conclusion

This chapter has presented the functional requirements for the adjunct mobile application. It has built on a UCD ABC-W framework, scenario-based approach and conceptualised the design to generate functional requirements for the adjunct mobile application that could facilitate adherence to prescribed PND treatments. This chapter has suggested requirements that include: managing and monitoring the use of multiple interventions; managing the impact of symptoms so that changes are noticeable; recording prescription instructions and providing positive prompts to users for better communication and self-guidance; self-incentives and just-in-time support. Future studies should investigate secondary data on requirements for the development of an adherence mobile application for PND. The following chapter will discuss design and implementation of the mobile application prototype. This will include identifying the accessibility and usability features of the mobile application prototype.
9. Design and implementation of an adjunct mobile application for postnatal depression

9.1. Introduction

This chapter concentrates on the design and implementation of a mobile application AbovePostnatalDepression prototype based on an Android OS platform. The Andriod OS was used because it is the most widely used operating system that has the potential to enhance user experience and utility (Adamakis, 2017). It is a powerful operating system that provides timely automated functions that could be used without internet connectivity (Gosling & Mason, 2015). AbovePostnatalDepression aims to support and facilitate women with PND to adhere to prescribed treatments. This research considers specific high level requirements in order to develop a mobile application that is accessible and usable for women with PND. Although, it is not anticipated that the mobile application will deliver extensive accessibility and usability features because this is beyond the scope of this research. The study follows a secondary approach to determine the accessibility and usability factors that were implemented in the development of the prototype.

9.2. Accessibility

Depression has been shown to affect cognitive functioning in activities that relate to learning; memory; attention and verbal ability (Boath et al., 2006; Good & Sambhanthan, 2014). Women with PND may experience a deterioration of their cognitive functioning (Cheryl Tatano Beck, 2002a). Therefore, there is a need to consider accessibility factors when developing a technology intervention for women with PND. Major accessibility issues that could be experienced by women with PND are memory loss, poor concentration and communication (Beck, 2002a; Danaher et al., 2013; Robertson, Grace, Wallington, & Stewart, 2004). Poor concentration and memory loss can lead women to missing prescribed treatments or scheduled appointments (Dennis & Chung-Lee, 2006; Gerhards et al., 2010; Knudson-Martin & Silverstein, 2009; Merry et al., 2012; O’Mahen et al., 2014; Pampallona et al., 2002). It could also impact upon the ease at which they understand and interact with technology (Good & Sambhanthan, 2014). This makes the consideration of poor concentration and memory loss vital for these population. Furthermore, women are also faced with difficulties of poor communication and interaction (Hewitt et al., 2009;
Morrell, 2006; Tsivos et al., 2015). This can impact on their relationship with their, infant other family and friends. Therefore it is crucial to consider these changes when designing a support software which will be used by women with PND.

Features such as self-monitoring tools, reminders, and prompts are often considered to be of potential use (Holtz et al., 2017; Omisade et al., 2017). Providing notifications and prompt could help women improve their communication (Holtz et al., 2017; Morrissey, Corbett, Walsh, & Molloy, 2016; Omisade et al., 2017). It could reduce memory load or transfer the need to remember tasks from the women to the technology device. Although people have highlighted becoming annoyed with receiving prompts, alerts, reminders, and messages. They described irritation or disappointment as a consequence of inaccurate, untimely, or irrelevant notifications or advice (Dennison, Morrison, Conway, & Yardley, 2013). Therefore, to mitigate any adverse effects, it is suggested that prompt and notifications should be user-instigated. Also, poor concentration and memory loss could make interface navigation challenging. However, W3C / WAI provides general guidelines to help design content that is accessible to people with cognitive impairments. These guidelines are cited as:

- Clearly structured content that facilitates overview and orientation
- Consistent labelling of forms, buttons, and other content parts
- Predictable link targets, functionality, and overall behaviour
- Different ways of navigating websites, such as through a hierarchical menu or search option
- Options to suppress blinking, flickering, flashing, or otherwise distracting content
- Simpler text that is supplemented by images, graphs, and other illustrations (Good & Sambhanthan, 2014).

### 9.3. Usability

"Usability is part of the broader term “user experience” and refers to the ease of access and/or use of a product or website" (Speicher, 2015). In this instance, the emphasis is to ensure that women with PND can use the developed system. It is crucial to consider usability issues that may cause obstructions to the user experience. This could include the way navigation and information are designed on the mobile application interface. Labelling, the positioning of text and ease of use are also crucial to considered for
these users. Although, more research is required to investigate usability factors when developing a mobile application for the postnatal depressed population. However, this research adopted the existing model of usability by Nielsen (1994). The five attributes of usability will be discussed in the next section.

9.3.1. Efficiency

Efficiency refers to the accuracy and completeness with which users can accomplish their objectives (Harrison et al., 2013). In this context, this attribute reflects the productivity of a user while using the application. Efficiency can be measured in a number of ways, such as the time to complete a given task or the number of steps required to complete a given task. In an effort to ensure efficiency of a system, Smith (2017) highlights the benefits of how scrolling can enhance efficiency. Scrolling best practices include creating focus points, breaking up your content, constructing quality and engaging content, and formatting your navigation to accommodate scrolling (Smith, 2017). In contrast, research suggests ensuring that each screen of a system should only complete one transaction (Chan, Wong, Lee, & Chi, 2009). In this case, women try to multi-task and might want to achieve roles as quickly as they can while ensuring accuracy (Stoet, O’Connor, Conner, & Laws, 2013). Chapter 8 also highlights that just-in-time application should be available to use anywhere and at any time. The overwhelming responsibilities and busy schedules of women was identified as significant to the proposed application. Therefore, while scrolling has useful attributes, care need to be taken to ensure that the software is coherent, compact sequential and logical so that users can entirely complete all the task they wish.

9.3.2. Satisfaction

Freedom from discomfort, and positive attitudes towards the use of the tool. Satisfaction is the perceived level of comfort and pleasantness afforded to the user through the use of the software (Harrison et al., 2013). User satisfaction should be reflected in the attitudes of the user towards the mobile application. This application will not be evaluated by women however in this research we assume that the practitioners are significant and have great influence on women’s decision. Practitioners evaluation view on satisfaction will be discussed in chapter ten of this thesis.
9.3.3. Learnability

Learnability is the ease with which a user can gain proficiency with an application. It typically reflects how long it takes a person to be able to use the software effectively. The system should be easy to learn so that the user can rapidly start getting work done with the system. It is essential to consider the possibility that women will experience learning difficulty (Doherty et al., 2010). We assume that for women with PND, interfaces and devices should easy to operate (Xue et al., 2012). The learnability of software can be through the performance of participants during a series of tasks and measure how long it takes the users to reach their goal. This could be achieved through the use of simple interaction techniques. For example, objects on the mobile application should be labelled unless their meaning is obvious or their meaning can be understood without labels (Travis, 2003). However, care must be taken when selecting labels in order to ensure consistency and to maintain a logical flow between items. The label should also explain the purpose and content of the given object and should be consistent across screen and task. A recent survey of mobile application users found that users will spend on average 5 minutes or less learning to use a mobile application (Flood, Harrison, Iacob, & Duce, 2012; Harrison et al., 2013). Along these lines, care ought to be taken to guarantee that women can accomplish their task rapidly.

9.3.4. Memorability

Memorability is the ability of a user to retain how to use an application effectively. Software might not be used on a regular basis and sometimes may only be used sporadically (Harrison et al., 2013). Women with PND struggle with memorability and might find it difficult to recall the user interface and how to use it on a subsequent visit (Danaher et al., 2013). The mobile application should be designed so that task is easy to remember so that anytime the user returns to the system after some time of not having utilised it they would not need to learn everything again. It is, therefore, necessary for users to remember how to use the software without the need to relearn it after a period of inactivity. It is suggested that the mobile application text should utilise short and familiar terminology user typically use to perform their task rather than new and complicated jargon when designing interface (Travis, 2003).
9.3.5. Errors

Nielsen (1994) states that users should make few errors during the use of a system and that if they do make errors they should be able to easily recover from them. The error rate of users may be used to infer the simplicity of a system. By understanding the nature of these errors it is possible to prevent these errors from happening in future versions of the application (Harrison et al., 2013). The mobile should have a low error rate, so that users make few errors during the use of the system and that if they do make errors they can quickly recover from them as well as not make further errors. This attribute is used to reflect how well the user can complete the desired tasks without errors. Error messages should be entirely explicit so as what the user should do to solve the problem (Travis, 2003). A suitable error message should be unambiguous about where the problems have occurred and what is the correct course of action. For example, the user should be notified immediately if they enter an unacceptable value into a field.

9.4. Accessibility and usability requirements

A number of requirements were derived from the accessibility and usability recommendations. This includes:

R 5. Mobile application should be coherent, compact, sequential and logical

R 6. Label and text included in the mobile application should be familiar and ensure consistency and logical flow.

R 7. Mobile application should utilise short and familiar terminologies

R 8. Error messages should be clear and unambiguous
9.5. **Evaluation of AbovePostnatalDepression against the general requirements, accessibility and usability**

The following section will discuss how AbovePostnatalDepression satisfies the functional requirements developed in chapter eight, accessibility and usability requirements which includes the following.

**R 1. Manage and monitor the use of multiple interventions**

**R 2. Manage the impact of symptoms so that changes are noticeable**

**R 3. Record prescription instructions and prompts increased self-monitoring**

**R 4. Support self-incentives and just-in-time support**

**R 5. Implement mobile application are is simple and logical**

**R 6. Provide labels and texts that are familiar and ensure consistent flow.**

**R 7. Implement mobile application that utilises short and familiar terminologies**

**R 8. Provide error messages that are clear and unambiguous**
<table>
<thead>
<tr>
<th>Requirements (R)</th>
<th>AbovePostnatalDepression Screen Shots</th>
<th>AbovePostnatalDepression Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. R5, R6, R7</td>
<td><img src="image" alt="Registration Screen" /></td>
<td><strong>Scenario</strong>: Hannah had downloaded the AbovePostnatalDepression, and she is at the clinic to see the therapist. She would be required to create a profile so that it is user specific and to control their privacy. The registration screen is the first screen shown to the user.</td>
</tr>
</tbody>
</table>
**Scenario:** Hannah is required to fill in her registration details. The application allows the user to create her profile by filling in the name, email, password and confirm password fields. The user will have to click on the register button to complete the registration. This returns the user to the login screen.
### Scenario:
Hannah will be required to log into the mobile application after registration. One of the reasons for this is to ensure that the user details are adequately saved and registered.

The user will be required to fill the login details and this is in line with the recommendation in 8.1.2. Users will only have to do this once except they intentionally log out of the application. In the case where a user has entered the wrong details the application will notify the user to enter the correct login details.

<table>
<thead>
<tr>
<th>3. R5, R6, R7</th>
<th><img src="image" alt="Login Screen" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Email</strong></td>
<td><a href="mailto:Omobolanle.omisade@port.ac.uk">Omobolanle.omisade@port.ac.uk</a></td>
</tr>
<tr>
<td><strong>Password</strong></td>
<td>**********</td>
</tr>
<tr>
<td><strong>Login</strong></td>
<td><img src="image" alt="Login Button" /></td>
</tr>
</tbody>
</table>

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No account yet? Create one
**Scenario:** Hannah wants to add some prescribed treatments into the mobile application. This is screen shown to the user upon successful registration and login. The user will need to click on the plus icon to add treatments detail. The system provides instructions for the user on what to do to create a "treatment reminder."
5. R1, R3, R4, R5, R6, R7

**Scenario:** Hannah clicked on the plus icon. Subsequently the add treatment reminder screen is displayed for her to add her prescribed treatment details. This application will allow the user record details and instructions given by practitioner. The user is required to fill in the treatment title, treatment details, treatment date, treatment time, create reminders and reminder repetition if needed.
6. R1, R3, R4, R5, R6, R7

**Scenario:** Hannah would like to add a notification to repeat the treatment every hour. The switch and bell icon button allow users to have control over prompt and notifications. This could help to alleviate any adverse effects of prompts and warnings.
Scenario: Hannah’s therapist prescribed CBT and Medication to her, so she has created two treatment options. One of the key features of the prototype was the to allow the user to manage and monitor multiple interventions. The application enables the user to view multiple treatments prescribed and few details on one screen. The system also makes the user aware that the treatment information they have created is saved. The user can even switch the reminder “off” or “on” on this screen.
Scenario: Hannah filled in one of the treatment details with the wrong description, and she needs to edit the treatment information. The system allows the user to edit and delete treatments information when required. A delete icon and save icon is shown to tell users that they can amend the treatment details.
**Scenario:** Hannah has previously set her application to notify her to use the CBT treatment at 16.00. The prototype allows the user to create prescribed usage reminders as many times as they desire. The user will get notified based on the information they have provided.
Scenario: Hannah would also like to manage and view the improvements of PND symptoms. The system allows the user to add details of symptom so that changes are noticeable. The user will be required to click on the menu option on the top-right side of the application. This menu also includes other useful functionalities of the system.
**Scenario:** Hannah clicked on the manage symptoms menu option to add PND symptoms. The system allows the user to create symptoms details by filling in the date, time and symptoms information, email, password and confirm password field. The user will have to click on the tick icon to complete the action. This arrow that points left allows the user to returns to the previous screen.
**Scenario:** While Hannah was creating the treatments detail she was not patient enough to type in the date using the on-screen keypads. The application is designed to be user-friendly, and therefore date calendar pop-up is shown in the middle of the screen to help the user quickly get through the task of adding the date, and this functionality is also available for time, repeat interval menu where the feature is useful.
<table>
<thead>
<tr>
<th>13. R8</th>
</tr>
</thead>
</table>

**Scenario:** Hannah would like to delete one of the treatments she has created.

The application allows the user to delete treatment if they do not require the feature.


9.6. Conclusion

This chapter builds on the functional requirements (discussed in chapter eight), accessibility and usability. It shows that the AbovePostanalDepression prototype design meets the recommended functional, accessibility and usability requirements criteria. The mobile application prototype provides features that support users in managing and monitoring multiple interventions. It is also designed so that user can manage treatment effect on symptoms, record prescription instructions, prompts and self-monitoring. The prototype facilitates self-incentives and just-in-time support. To ensure that user experience is enhanced the prototype implemented logical and straightforward user interface and interaction. Label and text included in the mobile application are familiar and were implemented in a consistent and reasonable method. It also used short and familiar terminologies as well as clear and unambiguous error messages. Further research should carry out extensive research on accessibility and usability features that might be desired by women with PND. The next chapter described the empirical evaluation of the mobile application prototype that will be carried out with practitioners who have experience providing support for women with PND.
10. Evaluating AbovePostnatalDepression

10.1. Introduction

The aim of this chapter is to present the empirical evaluation of the AbovePostnatalDepression mobile application prototype against the ABC-W. Chapter nine followed a secondary research approach to determine the accessibility and usability factors that were implemented in the development of the prototype. It further discussed how AbovePostnatalDepression embedded the functional requirements developed in chapter eight, accessibility and usability requirements. The evaluation which is the focus of the chapter will be carried out with practitioners who have experience providing support for women with PND (Doherty et al., 2010).

Research suggests that interventions strategies based on empirically validated theories are potentially more effective in changing health behaviours because they can explain how the intervention works (Michie & Abraham, 2004). Additionally, an intervention should have a sound theoretical basis, allowing the appropriate determinants of behaviour change to be targeted and effective intervention techniques to be identified (Ajzen, 2011). As previously explained in chapter four of this thesis, TPB is one of the most widely known and employed theories in behaviour change studies (White et al., 2015). TPB suggests that people’s attitudes towards a behaviour lead to the formation of a behavioural intention, thus the likelihood of performing a behaviour. The subjective norm is predicted by the normative belief and the motivation to comply. In this study, we will focus on the normative belief, a perception about the expectation of significant others. People often act according to their perception of what others (e.g., practitioner, family & friends) think that they should do. Therefore, their intention to perform a behaviour is potentially affected by people with whom they have close relationships. In line with this, we assume that the practitioners are significant and would have great influence on women’s decision to use a mobile application as a tool to facilitate increased adherence in PND. Furthermore, where practitioners are likely to have extensive contact with the client, they can provide valuable insight to problem users of a proposed system might encounter (Doherty et al., 2010).

The aim of this research is to involve PND practitioners as participants who will evaluate whether the AbovePostnatalDepression could be utilised as a tool that could potentially help women with postnatal women have control over their adherence
behaviour, and subsequently increase adherence to the prescribed intervention. We will also examine whether it could also serve as a tool to motivate the adherence behaviour, as well as help, facilitate sustained treatment outcome. Based on the TPB, the more favourable the professional’s opinion is, the more likely women will intend to use the mobile application as an adherence tool (Ajzen, 2011; Knabe, 2009).

10.2. Study aim and objectives

This study aims to evaluate the potentials of AbovePostnatalDepression against the features of the ABC-W framework that were described in chapter seven of this thesis. The objectives of this study are:

- To elicit practitioners view of the mobile application prototype.
- To assess the potentials of using an adjunct mobile application as a useful tool to increase treatment adherence, greater guidance and self-monitoring of prescribed PND treatments.
- Examine the influence of the intervention on TPB constructs (behavioural beliefs, subjective norms and control beliefs).

The primary hypothesis of this study is that practitioners will have a favourable perception that the adjunct mobile application will facilitate the adherence behaviour and sustained treatment effect for PND.

10.3. Design

The study utilises a quantitative survey to identify practitioners view of AbovePostnatalDepression. Survey data were collected using web-based questionnaire. We used an online questionnaire that was delivered via the internet instrument, Survey Monkey. Survey Monkey was used as a questionnaire tool because it allows research participants to speak in their own words, is convenient, and its one of the most popular tools used in academic research within the University departments’ that the researcher is affiliated with; that being Computing department. Furthermore, it enables researchers to download results in a Microsoft Excel spreadsheet, which facilitates easier coding and sorting of data. Prior to completing questionnaires, participants were invited to interact with AbovePostnatalDepression while receiving minimal direction from the researcher. The AbovePostnatalDepression mobile
application prototype was installed on participants choice of Android device. They were then asked to consider all that they have learned about the application and complete the questionnaire.

10.3.1. Participants

Participants in this study were practitioners who have experience providing support for women with PND via the social media, parenting support and fertility forums in the United Kingdom. Four participants in this study were people who took part in the study described in chapter six of this thesis. Participants in this study included two therapist and three midwives. The final sample size of 20 participants is determined adequate after reviewing effect sizes from available literature (Maxwell, 2005). However, a relatively small number of experts can provide extremely valuable data that would inform revisions to the program (Danaher et al., 2012a). Participants were selected purposely due to the limited access to the potential participants. The table below describes the participants involved in this study. Participants are given a pseudo name for this study.

Table 10.1: Participants characteristics

<table>
<thead>
<tr>
<th>Participant</th>
<th>Participant role</th>
<th>Type of intervention delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zain</td>
<td>Experienced antenatal and postnatal Depression therapist</td>
<td>Cognitive Behavioural Therapy and Psycho-Education</td>
</tr>
<tr>
<td>Sharon</td>
<td>Therapist</td>
<td>Cognitive Behavioural Therapy and Online support</td>
</tr>
<tr>
<td>Emily</td>
<td>Mid-wife</td>
<td>Pharmacological interventions</td>
</tr>
<tr>
<td>Chloe</td>
<td>Mid-wife</td>
<td>Talking Therapy</td>
</tr>
<tr>
<td>Sean</td>
<td>Mid-wife</td>
<td>Talking Therapy</td>
</tr>
</tbody>
</table>

10.3.2. Recruitment

Potential participants were recruited through advertisements in social media, parenting support and fertility forums based in the United Kingdom. Practitioners were people
who have, of their volition, made themselves available for advice and have lengthy experience of using therapies and techniques as part of their providing support for PND. Participants were informed of the aims and objectives of the study and offered information sheets and consent form. Participants were informed that they have the right to withdraw at any time during the study.

10.3.3. Ethical consideration

This research protocol has been granted full ethical approval from the University of Portsmouth Faculty of Technology Ethics Committee, see section A.3 (Reference: OO3). A complete description of ethical review relating to this research can be found in chapter four of this thesis.

10.3.4. Measures

Participants who are practitioners were asked to interact and engage with *AbovePostnatalDepression* for at least one week. The subsequent questionnaire was presented to measure constructs of the TPB (i.e., behavioural belief, subjective norm and control beliefs). Following Ajzen’s guidelines for constructing a TPB questionnaire, participants numerically rated the degree of match between *AbovePostnatalDepression* and specified TPB. A higher score will indicate a more positive attitude towards the *AbovePostnatalDepression* as a tool that has the potentials to facilitate PND treatment adherence. Furthermore, to assess the usability of the mobile application, participants were asked questions that were rated on a 5-point scale from strongly disagree to strongly agree.

10.3.5. Data analysis

The quantitative analysis will be conducted using IBM SPSS statistical package (Brace, Snelgar, & Kemp, 2012). The results from the collected data will report the mean and standard deviation this will help understand effects in the data (Brace et al., 2012). A higher mean value realates to greater intention towards *AbovePostnatalDepression*, whereas a lower mean relates to negative intention towards *AbovePostnatalDepression*. Also, the System Usability Scale (SUS) will be used to evaluate the usability of *AbovePostnatalDepression* (Danaher et al., 2012a).
Study will be sent to practitioners who provide support for PND on parenting support, fertility forums and social media.

Interested participants will click on the link provided and read information sheet.

- Consent given
  - No: Exclude
  - Yes

Does participant have experience providing support for women with PND?

- No: Exclude
- Yes

Participant will be provided with link to interact with AbovePostnatalDepression mobile application.

Mobile application usage

Did the participant interact with the mobile application?

- No: Exclude
- Yes

Continue survey

Demographics

Complete survey

End

Figure 10.1: Study flow diagram
10.4. Results

10.4.1. Behavioural beliefs towards the AbovePostnatalDepression

In this section, we present the results of the study on the attitude of practitioners towards the features of the AbovePostnatalDepression. This part of the study aimed to assess potentials of the mobile application to facilitate increased adherence and sustained treatment effect. In order to achieve this, we assessed the strength of professional’s beliefs on the potential of AbovePostnatalDepression to facilitate increased adherence, sustained treatment effect, and wellbeing. Responses to these questions will open the way to making improvements in the design and delivery of the tool and thus enhance its future effectiveness. It will also help identify its deficiencies and so facilitate redesign to overcome these.

The participants were required to rate five features of the AbovePostnatalDepression on a scale from 1 to 7 (1=unlikely and 7=likely). Four features scored on average more than 5.6 while just one feature scored 3.8. A description of the mean and standard deviation of the attitude toward the AbovePostnatalDepression is presented in table 10.2. Although, keeping users supported between different therapeutic sessions and help users to self-manage their well being effectively were there feature with the highest rates, participants have given all the features high scores. This will suggest that practitioners will have positive attitude toward the AbovePostnatalDepression.

<table>
<thead>
<tr>
<th>Table 10.2: Attitude to AbovePostnatalDepression ranked based on mean value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Increased adherence</td>
</tr>
<tr>
<td>Improve long-term sustained treatment outcome</td>
</tr>
<tr>
<td>Keep users supported between different therapeutic sessions</td>
</tr>
<tr>
<td>Help users to self-manage their well being effectively</td>
</tr>
</tbody>
</table>
10.4.2. Subjective norms as a predictor of using AbovePostnatalDepression

Subjective norms refer to the perceived social pressure to perform or not perform a target behaviour. People often act according to their own perception of what others (e.g., practitioner, family, and friends) think that they should do. Therefore, their intention to perform a behaviour is potentially affected by people with whom they have close relationships. In this context, we assume that practitioners have a close relationship with depressed women, they could expose them to information and experiences that may well affect their intention to use the mobile application. This section will assess the kind of pressure women might be faced with from professionals, even if they are already motivated to use the mobile application. We assume that practitioners could expose users to information and experiences that may well affect their intention to use the mobile application. Therefore we requested participants to rate their thought on what they and others might feel about AbovePostnatalDepression. Questions includes their thought of of other practitioners might think about AbovePostnatalDepression. It also includes their experince with providing several adherence techniques compared with the feature provided by the AbovePostnatalDepression.

The participants were asked to rate five features of the AbovePostnatalDepression on a scale from 1 to 7 (1=strongly disagree, and 7=strongly agree). One item used the (1=not easy and 7=extremely easy). For the subjective norm, a higher mean relates to greater perception to AbovePostnatalDepression where a lower number relates to negative opinions.

| Table 10.3: Subjective norm ranked based on mean value |
|-----------------------------------------|------|------|
| Thoughts about other practitioners opinion | 5 | 4.8 | .83 |
| Thoughts about recommending the mobile application to women | 5 | 5.8 | .83 |
Thoughts on ease of adherence  
5  5.2  .83

Thoughts on motivated women and the use of the mobile application  
5  5.6  .89

Thoughts on self-management  
5  7.0  .00

From table 10.3 it can be seen that participants think other people in the field will have positive perception toward the use of *AbovePostnatalDepression*. All participants believed that self-management is an essential feature that will be considered by other practitioners. This is in line with the literature and studies reported in chapter five and six of this thesis.

### 10.4.3. Perceived control beliefs as a predictor of using *AbovePostnatalDepression*

This section elicits the participant’s view of control factors that might be influenced as a result of using the Control beliefs are concerned with the presence of factors that can facilitate or inhibit performance of behaviour. *AbovePostnatalDepression*. Control factors considered in this research includes how *AbovePostnatalDepression* would impact treatment cost, duration, frequency, childcare and overwhelming responsibilities. These features were judged on a scale from 1 to 7. Table 10.4 demonstrates that control factors as included as feature of the *AbovePostnatalDepression* will be of benefit to women suffering from PND.

**Table 10.4: Mean value of control factors as features of *AbovePostnatalDepression***

<table>
<thead>
<tr>
<th>Feature</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of using mobile application</td>
<td>5</td>
<td>4.0</td>
<td>.70</td>
</tr>
<tr>
<td>Cost of using mobile application</td>
<td>5</td>
<td>4.2</td>
<td>.44</td>
</tr>
<tr>
<td>Treatment duration</td>
<td>5</td>
<td>3.8</td>
<td>.44</td>
</tr>
<tr>
<td>Childcare problems</td>
<td>5</td>
<td>4.4</td>
<td>1.14</td>
</tr>
</tbody>
</table>
AbovePostnatalDepression scored well in managing treatment cost, duration, frequency, childcare and overwhelming responsibilities. It is apparent that AbovePostnatalDepression is perceived to be a useful tool for facilitating adherence to PND treatments.

10.4.4. Usability

In this section, participants were asked to consider all they had learned about AbovePostnatalDepression and complete the usability scale that we slightly adapted to be appropriate for evaluating the AbovePostnatalDepression application. The System Usability Scale was modified to be suitable for assessing the proposed mobile application (Danaher et al., 2012b). It is envisaged that these questions will provide valuable data that would inform the revision of the mobile application. The usability rating was obtained from all participants. It is helpful to examine the proportion of responses across participants by the assigned adjusted SUS ratings (see Table 10.5). Using this perspective, we note that all participants assigned a score above 65%. For the combined sample the results for the SUS total score is reported as 79.5%. A SUS score of 73 has been described as good, a score of 85 as excellent, and a score of 100 as the best imaginable (Flood et al., 2012). Using the scoring interpretation for the overall adjusted SUS score results obtained, it appears that each of the practitioners found the interactions from the AbovePostnatalDepression mobile application to be very usable. However some comments that participants provided in relation the AbovePostnatalDepression were:

“In some cases, these women require more support than what we provide to them at the clinic.” Sharon

“It has good features, but I think this should be tested with women suffering from postpartum depression.” Zain
Table 10.5: System Usability Scale item responses: Combined sample (N=5);  

<table>
<thead>
<tr>
<th>Item</th>
<th>Negative</th>
<th>Postive</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think that users would use the mobile application frequently</td>
<td>60%</td>
<td>20%</td>
</tr>
<tr>
<td>I found the mobile application complex a</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>I thought the mobile application was easy to use</td>
<td>20%</td>
<td>40%</td>
</tr>
<tr>
<td>I think that users would need the support of a technical person to be able to use this mobile a</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>I found the various function in this mobile application well integrated</td>
<td>20%</td>
<td>60%</td>
</tr>
<tr>
<td>I thought there were too much inconsistencies in the mobile application a</td>
<td>60%</td>
<td>20%</td>
</tr>
<tr>
<td>I would imagine that user would learn how to use the mobile application very quickly</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Users will find the mobile application very cumbersome to use a</td>
<td>20%</td>
<td>40%</td>
</tr>
<tr>
<td>Users will be very confident that using mobile application</td>
<td>20%</td>
<td>80%</td>
</tr>
<tr>
<td>Users will need to learn a lot of things before using the mobile application a</td>
<td>40%</td>
<td>60%</td>
</tr>
</tbody>
</table>

a Values of responses to these items were reversed when scored

### 10.5. Discussion

There is a substantial gap for adherence to treatment for PND, and this requires a theoretical model of adjunct support (Omisade et al., 2017). Poor adherence characterises PND, and this is a key public health concern. This study applied the TPB framework to explain the behavioural intention of practitioners toward the features of AbovePostnatalDepression mobile application prototype. We envisaged that the more
favourable the attitude and subjective norm and the greater the perceived control, the stronger should be the behavioural intention. The results in table 10.1 suggests that practitioners involved had positive beliefs toward the features of AbovePostnatalDepression to facilitate prescribed treatment adherence. The high mean value further demonstrate the AbovePostnatalDepression could ensure long-term sustained treatment outcome. It can be seen that AbovePostnatalDepression will keep women with PND supported between different therapeutic sessions. This findings would mean that AbovePostnatalDepression as an additional intervention supports the features of ABC-W. Previous research that suggested that the provision of additional support to prescribed treatment could enhance achieving the desired outcome and sustained effect (Broom et al., 2015). Similarly, Turner and colleagues (2010) advised that additional support needs to remain available to women receiving the intervention, both during and after the intervention is completed.

As a result of the high mean in table 10.2, this study indicates that the decision to use AbovePostnatalDepression could be under the control of subjective norms. This means that if other practitioners have positive attitude towards AbovePostnatalDepression and there would be a positive normative pressure to use the mobile application as additional support to treatment. Following TPB rules, Positive pressure from practitioners could influence depressed women's attitude toward using AbovePostnatalDepression as an adjunct support. Furthermore, AbovePostnatalDepression, is seen to have the potentials to help women self-manage adherence to prescribed treatment and well being effectively. Results also suggested that other practitioner who provides support for women with PND will have positive intentions towards AbovePostnatalDepression. More importantly, AbovePostnatalDepression would be effective in managing factors that might negatively impact adhering to prescribed PND treatments.

Furthermore, this study suggested that AbovePostnatalDepression performed well regarding usability. Explicitly, the results supported that AbovePostnatalDepression was easy to use, not complex and depressed mother would use the proposed mobile application frequently. While the content of the mobile application was well integrated, participants thought that women would not need technical support to use the mobile application and they will be able to learn it quickly.
10.6. Conclusion

The findings in this study were positive behavioural beliefs, subjective norms and control beliefs toward the features *AbovePostnatalDepression*. TPB suggests that changing intentions can be accomplished by influencing attitudes, subjective norms and control beliefs. We anticipated that if the practitioners have more positive intentions toward the features of *AbovePostnatalDepression*, then the normative pressure on women with PND to use the mobile application as adjunct support will be positive, which is this case from our results. Future studies should consider using women with PND to evaluate *AbovePostnatalDepression* because this might open the way to making improvements in the design and delivery of the adherence tool and, thus, enhance its future effectiveness. We anticipate that more results will be obtained from studies carried out with fully integrated *AbovePostnatalDepression* mobile application with interaction from women suffering from PND. In the next chapter, we describe how the research questions proposed were addressed through the course of this research and draw some conclusions.
11. Conclusions

In order to finish this thesis, this chapter presents the conclusion of the research to demonstrate how far the research aims and objectives have been met. This includes a discussion of the contributions made to the current knowledge of the development of an intervention to facilitate increased adherence to prescribed PND treatments. The chapter also presents limitations of this research and directions for future work.

11.1. Addressing the research questions

In the introduction, we introduced four research questions that we will now attempt to answer.

**Research question 1:** What are the factors associated with adhering to PND interventions?

To deepen our understanding, we rigorously examined the effects of adherence and the factors associated with adhering to PND interventions in chapter three of this thesis. The findings significantly contributed to the understanding that suggests that non-adherence to treatment is a major problem faced by healthcare professionals and has a negative impact on a woman and her family. A lack of adherence to treatment was identified to increase the length of time spent in treatment for psychological disorders, as well as to decrease the long-term effect of the treatment outcome. The review played an essential role in establishing specific barriers to adhering to prescribed PND treatments. Significantly, we identified the following factors as being associated with adherence to prescribed PND treatments.

1. Provision for infant care during intervention (Honey et al., 2002; Reay et al., 2006; Rojas et al., 2007)
2. Providing convenient delivery location (Chabrol, et al., 2002; Prendergast & Austin, 2001)
3. The strategy of delivery facilitator (Slade et al., 2010; Turner et al., 2010)
4. Duration of intervention session (Chabrol, et al., 2002; Rojas et al., 2007; Turner et al., 2010)
5. Method of engagement during treatment delivery (Milgrom et al., 2011)
6. Flexible and convenient intervention time (Klier et al., 2001; O’Mahen et al., 2015; Reay et al., 2006; Slade et al., 2010)

7. Availability of adjunct support to treatment (Milgrom et al., 2011; O’Mahen et al., 2014; Rojas et al., 2007)

The significant findings from the review were followed by two concurrent mixed-method studies that elicited factors that could have an impact on PND treatments adherence from women and practitioners (Chapter 5 & 6). In order to rigorously approach this studies, we applied a UCD. Also, elements of TPB guided the investigation carried out in all the studies carried out in this research. The TPB has been proven to be effective in many previous studies. However, this is the first study that used the model as a theoretical lens to develop an adherence intervention for women with PND. The first study identified women’s adherence behavioural beliefs through the use of a questionnaire while the second study elicited practitioner’s views on intervention and techniques using interviews. At the end of these studies, the research contributes to the knowledge of factors that could inhibit adherence to prescribed PND interventions. These are:

1. Offering multiple intervention choices
2. Discussing the treatment delivery method.
3. Associating delivery with flexible delivery options.
4. Discussing options for adjunct support, when accessibility factors are no convenient.
5. Discuss the effect of the intervention on symptoms.
6. Discuss intervention and usage plan
7. Self-management could influence greater PND intervention outcome

**Research question 2:** What should be the elements of a PND treatment adherence framework?

Chapter 7 of this thesis aimed to answer the second research question. This section of the thesis built on the understanding of women’s beliefs discussed in chapter five, and the knowledge and skills of practitioners for improving PND treatment adherence and sustained outcome as shown in chapter six. Data from the enquiry subsequently lead to the development of the ABC-W adherence framework for PND. This was also complemented by results from the review and studies in chapter 2 and 3 which
provided invaluable insights into variables that could potentially influence PND treatment adherence. The results were combined to generate elements of the PND adherence framework, Adherence behavioural Change Wheel (ABC-W). Figure 11.1 shows the diagram already presented in chapter 7. Furthermore, this research suggested that there should be a discussion between practitioner and women on the variables of the ABC-W. This should be explored in an open and non-judgmental manner and involves dialogue between the layers. The general sequence for ABC-W is as follows:

- Identify that a woman’s intervention adherence behaviour needs to change.
- Discuss each element that could have an impact on adherence.
- Wheel elements of ABC-W around the different layers.
- Carry out each stage of the wheel, ensuring that they are matched with one another.
- Decide how adherence will be ensured.

Figure 11.1: First ABC-W prototype
**Research question 3:** What requirements can we infer from the PND adherence framework to inform the development of an adjunct mobile application?

As discussed in chapter eight of the thesis, the ABC-W framework informed the development of an adjunct mobile application prototype for PND, *AbovePostnatalDepression*. A scenario-based technique was used to conceptualise the preliminary characteristics of intended users and to infer a set of functional requirements that could be used for the mobile application development. Detailed description and rationale for a set of general requirements were presented using Volere shell, a requirement specification tool. Additionally, selecting the requirements preliminary accessibility and usability features were considered for the development of a mobile application for women with PND. Although future work addressing more specific accessibility and usability features for a PND mobile application will be required.

From the research in chapter eight and nine emerged a series of recommendations and requirements for the design and development of an adherence mobile application for PND.

**R 1.** Manage and monitor the use of multiple interventions

**R 2.** Manage the impact of symptoms so that changes are noticeable

**R 3.** Record prescription instructions and prompts increased self-monitoring

**R 4.** Self-incentives and just-in-time support

**R 5.** Implement mobile application are is simple and logical

**R 6.** Provide labels and texts that are familiar and ensure consistent flow.

**R 7.** Implement mobile application that utilises short and familiar terminologies

**R 8.** Provide error messages that are clear and unambiguous
Research question 4: Can the adjunct mobile application change women’s intervention adherence intentions and behaviour?

The mobile application prototype AbovePostnatalDepression was developed to manage and monitor the use of multiple interventions. In chapter ten of this thesis, we evaluated the potentials of AbovePostnatalDepression against the features of the ABC-W framework and whether the software might increase adherence to PND treatments. AbovePostnatalDepression also includes features designed to manage the impact of symptoms so that changes are noticeable; record prescription instructions and provide positive prompts to users for better communication and self-guidance; self-incentives and just-in-time support. It was particularly important that we make good use of expert-based evaluation strategies, given that the people often act according to their perception of what others think that they should do (Doherty et al., 2010). Women’s intention to perform a behaviour is potentially affected by people with whom they have close relationships. In this research, we assumed that the practitioners are significant and have great influence on women’s decision to adherence to treatments. Practitioners evaluated the AbovePostnatalDepression as a useful tool to increase treatment adherence, greater guidance and self-monitoring of prescribed PND treatments. It examined the influence of the intervention on the theory of planned behaviour constructs. Our conclusions were based on the TPB; the more favourable the practitioner’s opinion is, the more likely women will intend to use the mobile application as an adherence tool (Ajzen, 2011; Knabe, 2009).

AbovePostnatalDepression is perceived by practitioners as a useful, usable and desirable tool for facilitating adherence to prescribed PND interventions. In section 10.5 we discussed that AbovePostnatalDepression could keep women with PND supported between different therapeutic sessions. We also demonstrated that if practitioners have a positive attitude towards AbovePostnatalDepression, there would be a positive pressure to use the mobile application as additional support to treatment. Following TPB rules positive pressure from practitioners could influence depressed women’s attitude toward using AbovePostnatalDepression as adjunct support. Furthermore, AbovePostnatalDepression is seen to have the potentials to help women self-manage adherence to prescribed treatment as well as managing factors that might negatively impact adhering to prescribed PND treatments. This is achieved by using features of the mobile application such as self-incentives, prompts and reminders and managed record keeping.
11.2. Original contribution to knowledge

Firstly, this research contributes to the existing literature that draws from different strategies and interventions used to treat PND, their application, strengths and weaknesses. In this research, we combined studies that used pharmacological, psychological, multicomponent interventions and usual care, with varying adherence strategies (see chapter 3). The results obtained during the literature review reinforced the importance of adhering to PND treatment. It further contributes to identifying the impact of adherence on depressed women and the factors that could be associated with adhering to PND interventions.

Secondly, this is the first research that used a theoretical lens to identify the influencing factors of the treatment adherence behaviour for PND. The use of mixed methods strategy where the quantitative opinion of women complimented the qualitative perception of practitioners on the factors that inhibit adherence to PND treatments is original. This rigorous strategy helped established the prescribed treatments adherence factors. This method could be applied in other research on providing support for the wellbeing of women with PND.

Thirdly, factors associated with adhering to PND interventions contributed to the attributes of a treatment adherence framework, ABC-W. To the best of our knowledge, the ABC-W is the first PND adherence framework that could be used to identify and address women's behavioural, subjective norms, control beliefs on adhering PND interventions. It could be used to bridge the gap between the intention to adhere to treatment and volitional control. The ABC-W could facilitate a shared decision-making environment between practitioners and women with PND. This will enable the clarification of concerns and support users in making decisions about how to adhere to treatment. It is important to note that the ABC-W was disseminated at the first Maternal Mental Health Alliance Conference in the United Kingdom which contributed greatly to the knowledge in the field.

Fourthly, this research developed a set of high level requirements that could be used to inform the development of a mobile application to facilitate adhering to PND treatments. As discussed in chapter ten the research also establishes that a mobile application could be a useful tool to increase treatment adherence, greater guidance and self-monitoring of prescribed PND treatments. It further demonstrated that the
mobile application could facilitate changes in adherence intentions and behaviour. More importantly, this is the first research to develop requirements, develop and evaluate a mobile application that could facilitate adherence to prescribed PND treatments.

Finally, the findings from this research could be used in further research. Not only does this research provide a useful contribution to the maternal depression field, but it also provides insightful knowledge from which others in the mental health field might benefit. This can include information for those that intend to deepen their understanding of factors that are inhibit adhering to prescribed PND treatment. Health practitioners or mobile application developer who would like to design and develop effective treatment adherence tool could also benefit from this research. Researcher who intend to rigorously approach their study could adapt the strategy applied in this research project.

11.3. Impact of research

This research significantly contributes to the knowledge on providing improved adherence to prescribed PND treatments. The findings from this research will be useful for health and mental health providers who need to be aware of the factors that could to be considered when providing PND treatment adherence interventions. The ABC-W has the potentials to facilitate a shared treatment decision-making environment for women with PND. It is hoped that it will enable the clarification of concerns and support practitioner and women in making decisions about how to adhere to prescribed treatment. We also hope that use of the ABC-W is not restricted to the PND domain because there is potential for utilising the framework for the treatment of other categories of depression treatment adherence.

For developers and future researcher, the set of requirements derived from the ABC-W can be used in the design and implementation of mobile technology adherence support for women with PND. It is likely that the set of requirements will be extended in the coming years and more mobile technology interventions are developed and as technology becomes more widely used in therapeutic practice. Importantly, the requirement could be used to develop an adjunct mobile application to facilitate treatment adherence for women with PND. It is envisaged that an adjunct mobile application could potentially be used to motivate postnatal depressed women to
adhere to treatment and sustain treatment outcome in the long-term. By using the *AbovePostnatalDepression* mobile application there is a possibility of reducing procedural cost or efforts required by practitioner and women alike in ensuring increased adherence to prescribed treatments.

### 11.4. Research limitation

Despite the importance and novelty of this research, there are limitations that should be considered. Firstly, there were some methodological problems with the studies included in the literature review conducted in this research. Studies used a range of treatments, delivery and adherence measures at different time points after childbirth and this makes it difficult to explain how PND progresses over time. Research on factors that determine women’s engagement with treatment after childbirth is limited. This is an important gap to be addressed, particularly as effective engagement can enhance treatment adherence (Gerhards et al., 2010; Omisade et al., 2017). Furthermore, there are no extensive studies using adjunct intervention such as mobile application, to provide additional support. This resulted in difficulty concluding on the impact of PND treatment delivery and its subsequent adherence.

Secondly, the TPB, when used as conceptualised by Ajzen (1998), does not factor in personality and demographic variables. The theory establishes that variables can be accounted for in the theory if and only if they influence the underlying belief that determines the attitude towards the act and subjective norm. This research could not demonstrate that the personality and demographics have an impact on adhering to prescribed treatment. Therefore, we chose not to include these in our conclusions.

Thirdly, the studies conducted in chapter 5, 6 and 10 were not representative of all participants. Although participants satisfied eligibility criteria, we note that the results may not be necessarily generalised to the population of postnatal women and practitioners. There is a possibility that the study carried out in chapter 5 of this thesis which only used participants who were women with previous diagnosis of PND, yet who had not suffered any symptoms of PND in the last two years before recruitment may have impacted the results from the study. Fourthly, it is important to acknowledge that the user, task, environmental, accessibility and usability requirements described in the thesis were based on preliminary data and not extensive because it is beyond the scope of this research.
Finally, *AbovePostnatalDepression* is simply a prototype, which might have limited the findings. We could have identified problems that might open the way to making improvements in the design and delivery of the adherence tool and, thus, enhance its future effectiveness. The mobile application prototype could also have been evaluated by women who are suffering from PND; however, due to ethical considerations as discussed in chapter 4, this is not the case in this research. There are no other studies to make comparisons. Therefore it is difficult to appraise the AbovePostnatalDepression critically.

### 11.5. Future research directions

Future systematic reviews may be able to be more restrictive to adhering to prescribed PND treatments once more studies begin to appear in the academic literature that is more robust and concrete in purpose. It is anticipated that the research would publish empirical evidence providing a detailed description of ABC-W. Future research should aim to evaluate the effectiveness of the ABC-W with practitioners and women who suffer from PND on a much larger scale. This evaluation may bring to light problems that might be encountered when using the adherence tool and further opportunities to improve the ABC-W. There is also a need for additional research to examine the relationships between the behavioural belief, subjective norm and the control factors towards the use of *AbovePostnatalDepression*. This may result in greater conclusions of the intentions to use the mobile application to facilitate adhering to prescribed PND treatment. It will also be useful to continue to explore behavioural beliefs of women with PND towards *AbovePostnatalDepression*.

Future research may also focus on investigating secondary data on requirements for the development of an adherence mobile application for PND. In the future, we plan to continue to explore and evaluate *AbovePostnatalDepression* regarding its usability, suitability and appropriateness with women with PND as potential participants. Further, we plan to collect data relating to the acceptance of *AbovePostnatalDepression*. We consider accessibility to be of paramount importance when developing interfaces, future studies should consider the provision of a tool for customising the interface for people with mental illness and disabilities given the likelihood of impaired cognitive functioning. There is a possibility that *AbovePostnatalDepression* could include the provision of a search facility of recommended words and further developed for other mobile platforms such as iOS and cross-platform devices.
11.6. Finally

The research has developed a theory-based mobile health model to support the wellbeing and intervention adherence of women with PND. The TPB has been proven to be effective in many previous studies (Dubay et al., 2015; Ko et al., 2004; White et al., 2015). However, this is the first study that used the model as a theoretical lens to develop an adherence intervention for women with PND. This study identified factors that influence non-adherence to prescribed PND treatments. These factors were used to inform the development of a PND adherence framework. The framework was further used to shape the requirements of an adjunct mobile application prototype that could facilitate improved adherence to the prescribed PND intervention. The mobile application prototype was evaluated by practitioners who demonstrated a positive attitude toward the software, thus indicating potential that the tool could be recommended to, and used by women suffering from PND.

It is hoped that the current work can guide future studies, leading to the acceptance and evaluation of the ABC-W, the AbovePostnatalDepression mobile application to facilitate prescribed interventions and, most importantly improve the quality of life of women suffering from PND. Their suffering and the effect on those close to them, cannot be underestimated. Whilst this research makes no claims to cure PND, feedback from PND support practitioners was indeed promising on the benefits that the proposed application could have on increasing adherence to the prescribed intervention. This, in turn, could impact positively on the wellbeing and lives of many women with PND.
References


study on women at risk. *Psychological Medicine*, 32(6), S0033291702006062. https://doi.org/10.1017/S0033291702006062


Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., …


<table>
<thead>
<tr>
<th>Word</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence</td>
<td>Adherence, which will be discussed in more detail later in chapter three, is defined as the extent to which a person's behaviour conforms to medical or health advice (Bruer, 1982, Pampallona et al., 2002).</td>
</tr>
<tr>
<td>Adjunct</td>
<td>Additional</td>
</tr>
<tr>
<td>Attitude</td>
<td>Attitude are the approaches, opinions and mind set that you have developed through your upbringing and learning experience.</td>
</tr>
<tr>
<td>Belief</td>
<td>Belief can be described as things in life that you feel strongly about, that guide you in your daily life and are linked very closely to your morals and values.</td>
</tr>
<tr>
<td>High attrition</td>
<td>High attrition means that the effect of treatment is not sustained for a long time.</td>
</tr>
</tbody>
</table>
A. Ethical approvals

A.1. Study one

Technology Faculty Ethics Committee
ethics-tech@port.ac.uk

Date 5/2/16

Applicant: Bola Omosade
Address: School of Computing, University of Portsmouth

Dear Bola Omosade,

Study Title: The views of mothers with previous diagnosis of postnatal depression on the impact of therapy and use of mobile technology.

Ethics Committee reference: BO1

Thank you for submitting your documents for ethical review. The Ethics Committee was content to grant a favourable ethical opinion on the basis described in the application form, protocol and supporting documentation, subject to the general conditions set out in the attached document.

This is a valuable study of an issue of international social concern. The Faculty Ethics Committee are happy with the procedures put in place to safeguard participants and to ensure that recruitment is targeted in an appropriate way. Subject to the minor typographical errors pointed out in our email of 3/2/16 being rectified we happy to grant a favourable opinion for your study.

Please note that the favourable opinion of the EC does not grant permission or approval to undertake the research. Management permission or approval must be obtained from any host organisation, including University of Portsmouth, prior to the start of the study.

Documents reviewed

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Form</td>
<td>V2</td>
<td>16/12/15</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>V2</td>
<td>16/12/15</td>
</tr>
</tbody>
</table>
Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements set out by the University of Portsmouth.

Reporting and other requirements

The attached document acts as a reminder that research should be conducted with integrity and gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Notification of serious breaches of the protocol
- Progress reports
- Notifying the end of the study

Feedback

You are invited to give your view of the service that you have received from the Faculty Ethics Committee. If you wish to make your views known please contact the administrator, Emma Bain at ethics-tech@port.ac.uk

Please quote this number on all correspondence: OM1

Yours sincerely and wishing you every success in your research,

John Williams
Chair

Email: ethics-tech@port.ac.uk
A.2. Study two

Technology Faculty Ethics Committee
ethics-tech@port.ac.uk

Date: 4/7/10
Omobilani Omisade
School of Computing

Dear Omobilani,

<table>
<thead>
<tr>
<th>Study Title</th>
<th>Professionals' views of therapy, techniques and the use of mobile apps to support women with PND.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethics Committee reference:</td>
<td>002</td>
</tr>
</tbody>
</table>

The Ethics Committee reviewed the above application by an email discussion forum between the dates of 23/6/16 and 4/7/16.

Ethical opinion
The members of the Committee present gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the general conditions set out in the attached document.

Conditions of the favourable opinion
1. That the submission is amended to make clear the location and nature of the interview or questionnaires.
2. That you address the typos and inconsistencies supplied by email.

Recommendations: (You should give these due consideration but there is no obligation to comply or respond)
The Committee recommends that you get the application and documents proof read for grammar and spelling, and

You need not provide evidence of compliance; the EC will assume that you will not commence your research until you have met the conditions stated above.
The favourable opinion of the EC does not grant permission or approval to undertake the research. Management permission or approval must be obtained from any host organisation, including University of Portsmouth, prior to the start of the study.

Summary of discussion at the meeting

The Committee still has some confusion over the exact nature of the study as interview and questionnaire were used somewhat interchangeably. There are also many typos in the document. Overall they decided that the study is relatively low risk and trust the study team to amend the documents appropriately before commencing the study.

Documents reviewed

The documents reviewed at the meeting were:

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Form</td>
<td>V2.2</td>
<td>10/03/16</td>
</tr>
<tr>
<td>Participant Information Sheet</td>
<td>V1</td>
<td>10/03/16</td>
</tr>
<tr>
<td>Consent Form</td>
<td>V1</td>
<td>10/03/16</td>
</tr>
<tr>
<td>Invitation</td>
<td>V1</td>
<td>10/03/16</td>
</tr>
<tr>
<td>Interview Questions</td>
<td>V1</td>
<td>10/03/16</td>
</tr>
</tbody>
</table>

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements set out by the University of Portsmouth

After ethical review

Reporting requirements

The attached document acts as a reminder that research should be conducted with integrity and gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Notification of serious breaches of the protocol
- Progress reports
- Notifying the end of the study
Feedback

You are invited to give your view of the service that you have received from the Faculty Ethics Committee. If you wish to make your views known please contact the administrator ethics-tech@port.ac.uk

Please quote this number on all correspondence: 002

Yours sincerely and wishing you every success in your research

John Williams
Chair Technology FEC

Email: ethics-tech@port.ac.uk
A.3. Study three

Technology Faculty Ethics Committee
ethics-tech@port.ac.uk

Date: 19/10/17
Omobolanle Omisade
School of Computing

Dear Omobolanle,

<table>
<thead>
<tr>
<th>Study Title:</th>
<th>PROFESSIONALS’ VIEWS OF AN ADJUNCT MOBILE APPLICATION TO IMPROVE ADHERENCE TO TREATMENT IN WOMEN WITH POSTNATAL DEPRESSION.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethics Committee reference:</td>
<td>CO3</td>
</tr>
</tbody>
</table>

The Ethics Committee reviewed the above application by an email discussion between the dates of 13/10/17 and 18/10/17.

Ethical opinion

The members of the Committee present gave a favourable ethical opinion of the survey on the basis described in the application and supporting documentation.

Conditions of the favourable opinion

- There is contradiction in the application as to whether the method is solely survey or if interviews will be undertaken (e.g. Participant Information Sheet). If interviews are being proposed then an interview plan will need to be submitted to EthC. If just a survey is proposed then the Application needs to be modified to remove reference to interviews.

- The document needs to be edited to remove the frequent grammatical errors, inconsistent referencing, improve the explanation of methods and complete the reference list.
If only a survey is proposed then these modifications are delegated to the applicant and supervisors, but a final version should be lodged with FEthC. Data collection can also begin before the final document is prepared.

**Recommendations:** (You should give these due consideration but there is no obligation to comply or respond)

- Some reassurance of the identity of professionals on forums should be sought to ensure the validity of data collected.

- The statistical analysis should be reviewed to ensure the most appropriate methods are used, as it unclear how t-test and ANOVA will be applied.

The favourable opinion of the EC does not grant permission or approval to undertake the research. Management permission or approval must be obtained from any host organisation, including University of Portsmouth, prior to the start of the study.

**Summary of discussion at the meeting**

The application was given a favourable opinion by the reviewers, but there was general agreement that the document was rather confused in places.

**Documents reviewed**

The documents reviewed at the meeting were:

<table>
<thead>
<tr>
<th>Document</th>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>V2</td>
<td>12/10/17</td>
</tr>
<tr>
<td>Participant Information Sheet</td>
<td>V1</td>
<td>12/10/17</td>
</tr>
<tr>
<td>Questionnaire/Survey</td>
<td>V1</td>
<td>12/10/17</td>
</tr>
</tbody>
</table>

**Statement of compliance**

The Committee is constituted in accordance with the Governance Arrangements set out by the University of Portsmouth.
After ethical review

Reporting requirements

The attached document acts as a reminder that research should be conducted with integrity and gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Notification of serious breaches of the protocol
- Progress reports
- Notifying the end of the study

Feedback

You are invited to give your view of the service that you have received from the Faculty Ethics Committee. If you wish to make your views known please contact the administrator ethics-tech@port.ac.uk

Please quote this number on all correspondence: 003

Yours sincerely and wishing you every success in your research

John Williams

Chair Technology FEC

Email ethics-tech@port.ac.uk
B. Women’s perception of factors affecting PND interventions adherence

B.1. Final questionnaire

1. What is your gender? (If male, END)

☐ Male  ☐ Female

2. Do you presently suffer from postnatal depression? (If yes, END)

☐ Yes  ☐ No

3. Have you had postnatal depression in the past? (If answered no, END)

☐ Yes  ☐ No

4. Have you received any treatment for postnatal depression in the past? (If no, END)

☐ Yes  ☐ No

5. If ‘yes’, what therapy did you use for postnatal depression? (Please tick all that apply)

<table>
<thead>
<tr>
<th>Therapy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Behavioural Therapy</td>
<td></td>
</tr>
<tr>
<td>Monitoring and assistance (by a GP, Nurse or Therapist)</td>
<td></td>
</tr>
<tr>
<td>Medication</td>
<td></td>
</tr>
<tr>
<td>Psycho-education and information</td>
<td></td>
</tr>
<tr>
<td>Self-help from peer group</td>
<td></td>
</tr>
<tr>
<td>Interpersonal Therapy</td>
<td></td>
</tr>
<tr>
<td>Well-being Therapy</td>
<td></td>
</tr>
</tbody>
</table>
6. Which ONE of these therapies did you find MOST effective for postnatal depression? *(Please choose one)*

- [ ] Cognitive Behavioural Therapy
- [ ] Monitoring and assistance (by a GP, Nurse or Therapist)
- [ ] Medication
- [ ] Psycho-education and information
- [ ] Self-help from peer group
- [ ] Interpersonal Therapy
- [ ] Well-being Therapy
- [ ] Problem-solving Therapy
- [ ] No treatment
- [ ] Other

7. How effective was the therapy you chose in question 5 in addressing the following? *(Please complete for all statements)*

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>It helped to reduce my isolation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It helped me talk to other people</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It helped me prioritise demands on things I have to do</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>Agree</td>
<td>Neither agree nor Disagree</td>
<td>Disagree</td>
<td>Strongly disagree</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------</td>
<td>-----------------------------</td>
<td>---------</td>
<td>------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>It helped my relationship with my children</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>It helped reduce my stress</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>It helped me to manage negative thoughts</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
<tr>
<td>It helped me to have faith in myself</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
</tbody>
</table>

8. **How was your MOST effective therapy for postnatal depression delivered? (Please tick all that apply)**

- ☐ Help from sessions with therapist (such as GP, Psychologist)
- ☐ Help from home-visits from health care workers
- ☐ Help from structured sessions with other women suffering from postnatal depression
- ☐ Help from online self-help program
- ☐ Without help
- ☐ Completely unable to use therapy

9. **Which ONE of these therapy delivery approaches did you find MOST effective for postnatal depression? (Please choose one)**

- ☐ Help from sessions with therapist (such as GP, Psychologist)
- ☐ Help from home-visits from health care workers
- ☐ Help from structured sessions with other women suffering from postnatal depression
- ☐ Help from online self-help program
- ☐ Without help
- ☐ None
- ☐ Other (Please specify)
For the next five questions, please answer with your MOST successful therapy in mind.

10. How long did it feel you had to wait between when you were diagnosed with postnatal depression and when you started receiving therapy? (Please choose one)
   - [ ] It felt like days
   - [ ] It felt like weeks
   - [ ] It felt like months
   - [ ] Not sure
   - [ ] Not applicable

11. How effective was your most successful therapy in assisting your recovery from postnatal depression?
   - [ ] It made me feel much better than when I had PND
   - [ ] It made me feel better than when I had PND
   - [ ] It made no difference
   - [ ] It made me feel worse when I had PND
   - [ ] It made me feel much worse when I had PND
   - [ ] Not sure

12. When you had appointments to receive therapy, how convenient was the location of the facility for you?
13. How affordable was the cost of therapy to you? Costs include bus fare, travel costs, child care or time of work.

- Easily affordable
- Fairly affordable
- Adequately affordable
- Not very affordable
- Not at all affordable
- Not sure
- Not applicable because

14. Thinking about the time you spent on each appointment, how acceptable did you find the length of time spent receiving treatment?

- Very acceptable
- Moderately acceptable
- Not very acceptable
- Definitely not acceptable
- Not sure
- Not applicable
15. How frequently did you use your most successful therapy for postnatal depression?

- Every day
- Every week
- Every 2-3 weeks
- Every month
- Every 2-3 months
- Every 4-6 months
- Once or twice a year

16. How long did you have to use your most successful therapy for postnatal depression until recovery?

- Less than 6 months
- 6 months to less than 1 year
- 1 year to less than 2 years
- 2 years or more
- Not sure

17. How often did you follow instructions specific to using your therapy when you had postnatal depression?

- Always
- Regularly
- Sometimes
- Rarely
- Never
- Not applicable

18. If you had postnatal depression again, would you prefer the same therapy?

- Yes
- No
- Not sure
19. If you have indicated ‘yes’ to the above question, please state why


20. If you have indicated ‘no’ to the above question, please state why


21. How satisfied were you with the overall support you received from family members and friends?

   - Very satisfied
   - Satisfied
   - Neutral
   - Dissatisfied
   - Very dissatisfied
   - Not sure
   - Not applicable

   The next few of questions are going to ask you about your use of technology e.g. emailing or social networking.

22. For general purpose, how often did you have access to the following?

<table>
<thead>
<tr>
<th>Always</th>
<th>Regularly</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
<th>Not sure</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop PC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laptop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 23. If support for postnatal depression therapy were available via mobile app, how likely would you use it?

- [ ] Extremely likely
- [ ] Somewhat likely
- [ ] Neutral
- [ ] Somewhat unlikely
- [ ] Extremely unlikely
- [ ] Not sure

### 24. If a mobile app was developed as an additional support for PND, how useful do you think it will be?

<table>
<thead>
<tr>
<th>It can help practice techniques learnt (Such as coping techniques, attachments styles)?</th>
<th>Not useful at all</th>
<th>Rarely useful</th>
<th>Might be useful</th>
<th>Probably useful</th>
<th>Definitely useful</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
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<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>It can help adhere to therapy (For example appointment reminders, medication reminders)</th>
<th>Not useful at all</th>
<th>Rarely useful</th>
<th>Might be useful</th>
<th>Probably useful</th>
<th>Definitely useful</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>It can facilitate parenting practices (For example keeping track of infant</th>
<th>Not useful at all</th>
<th>Rarely useful</th>
<th>Might be useful</th>
<th>Probably useful</th>
<th>Definitely useful</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
</tr>
</tbody>
</table>
feeding, sleep and other cues)

It can help engage in previously valued and meaningful activities

It can help facilitate seeking support from family or friends

25. How much time would you be willing to spend using this mobile app each day?

The next few of questions are going to ask you about your last episode of postnatal depression.

26. How old were you when you had your last episode of postnatal depression?

27. What were your living arrangements when you had postnatal depression?

  - [ ] Living with partner only
  - [ ] Living with partner and children
  - [ ] Living alone
28. How many children did you have when you had postnatal depression?

[Blank]

29. How long did you have postnatal depression for?

[Blank]
B.2. Participant information sheet

Researcher: Omobolanle Omisade
Email: omobolanle.omisade@port.ac.uk
Supervisor: Dr Alice Good
Email: alice.good@port.ac.uk

Study Title: The views of mothers with previous diagnosis of postnatal depression on the impact of therapy and use of mobile technology.

I would like to invite you to take part in my research. You are under no obligation to participate and your choice will have no impact either positive or negative. Before you decide I would like you to understand why the research is being done and what it would involve for you. Please ask us if there is anything that is unclear.

We are looking for participants who have suffered from PND and used therapy in the past, but specifically NOT in the last two years, to complete a survey on exploring views on the impact of therapy and use of mobile technology.

What is the purpose of the study?

The purpose of this study is to explore whether the use of mobile technology can serve as additional support and an intervention delivery technique for women with PND. In addition, this study aims to gain the opinion of women on therapy traditionally used for PND that could be adapted and implemented via mobile technology delivery techniques.

Why have I been invited?

You may have had previous episodes of PND but not in the last two years. You may have responded to an advertisement on a PND support group. I am interested in gaining a better understanding from diverse demographics.

Do I have to take part?
No. It is up to you to decide to join the study as participation is voluntary and you could opt out at any stage of the study without any justification. The decision to withdraw will not affect you in any way or form. If you agree to take part, we will then ask you to sign an informed consent form.

**What will happen to me if I take part?**

If you decide to take part in this study, you will be required to complete a survey, which will last approximately 10-15 minutes. There will be some questions relating to your demographics, then there will be a series of questions relating to your therapy and delivery approach. Some of the questions will explore your opinion on the time spent using therapy, financial aspects and the use of mobile technology as an additional support for PND. Please note that you will need to answer ALL questions in order to complete the survey.

**What are the possible disadvantages and risks of taking part?**

There are no foreseeable risks or disadvantages associated with taking part in this study. However, in the likelihood of unforeseen circumstances, there are links and numbers to support group that can provide help.

**What are the possible benefits of taking part?**

Although there are no direct benefits to you, the results of this study will contribute towards a better understanding of the modification of therapy that can be used to provide additional support for women with PND.

**Will my data be confidential?**

Your anonymous responses (raw data) will be kept securely by the Principal Investigator. In particular, the data will be stored electronically on a password protected computer. The data may be presented to others at research meetings, or published as a project report, academic dissertation, scientific paper or book, or in future research
studies approved by an appropriate Faculty of Technology Ethics Committee of the University of Portsmouth.

Your responses (raw data) will not be passed to anyone outside the study team without your express written permission. The exception to this will be any regulatory authority, who may have the legal right to access the data for the purposes of conducting an investigation in exceptional cases. The raw data will be retained for 4 years following publication (in line with APA guidance). When it is no longer required, the data will be disposed of securely.

**What if there is a problem?**

If you have a concern about any aspect of this study, you should ask to speak to the research supervisor, who will do their best to answer your questions [details on page 1]. If you remain unhappy and wish to complain formally, you should contact:

Head of School.
Dr Nick Savage.
Email: nick.savage@port.ac.uk

**Who is organising and funding the research?**

This research is self-funded by the researcher (Omobolanle Omisade). None of the researchers or study staff will receive any financial reward for conducting this study.

**How can I contact researcher if I have any further questions?**

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Supervisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omobolanle Omisade</td>
<td>Dr Alice Good</td>
</tr>
<tr>
<td>School of Computing</td>
<td>School of Computing</td>
</tr>
<tr>
<td>University of Portsmouth</td>
<td>University of Portsmouth</td>
</tr>
<tr>
<td>Buckingham Building, Lion Terrace, Portsmouth (UK)</td>
<td>Buckingham Building, Lion Terrace, Portsmouth (UK)</td>
</tr>
<tr>
<td>PO1 3HE</td>
<td>PO1 3HE</td>
</tr>
<tr>
<td>Email: <a href="mailto:alice.good@port.ac.uk">alice.good@port.ac.uk</a></td>
<td>Email: <a href="mailto:nick.savage@port.ac.uk">nick.savage@port.ac.uk</a></td>
</tr>
</tbody>
</table>
Email:
omobolanle.omisade@port.ac.uk

Thank you for taking time to read this information sheet and for considering volunteering for this study. If you do volunteer for this study your consent will be sought on the following page. If you wish to retain a copy of your informed consent, please print the relevant page before continuing to the survey.
B.3. Consent form

Researcher: Omobolanle Omisade  
Email: omobolanle.omisade@port.ac.uk  
Supervisor: Dr Alice Good  
Email: alice.good@port.ac.uk

Study Title: The views of mothers with previous diagnosis of postnatal depression on the impact of therapy and use of mobile technology

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.
3. I understand that data collected during the study, may be looked at by individuals from the University of Portsmouth, or from regulatory authorities. I give permission for these individuals to have access to my data.
4. I understand that the results of this study may be published and/or presented at meetings and conferences. I give my permission for my anonymous data, which does not identify me, to be disseminated in this way.
5. I agree to the data I contribute being retained for future research.
6. I agree to take part in the above study.

If you agree to the above statements and continue to want to take part in the study, please click on the “Next” button below, which will take you to the survey. By clicking “Next” you indicate your consent to your participation in this study.
B.4. Debrief form

Researcher: Omobolanle Omisade
Email: omobolanle.omisade@port.ac.uk
Supervisor: Dr Alice Good
Email: alice.good@port.ac.uk

Study Title: The views of mothers with previous diagnosis of postnatal depression on the impact of therapy and use of mobile technology

Thank you for taking part in this study.

Mobile technology could be an opportunity to offer mothers suffering from postnatal depression additional and ‘just-in-time’ support. This research is a study to elicit views from mothers with a previous diagnosis of PND, to provide an understanding of the aspects of intervention that are important to women with PND.

The result of the study will be used to develop a set of principles in form of requirements that could be used to inform the development of mobile technologies which may provide additional support to therapies postnatal mothers receive.

Once again thank you for your participation, it is greatly appreciated. If you are interested in the results of the study, have questions concerning your participation or would like to withdraw your data, please contact

Researcher
Omobolanle Omisade
School of Computing
University of Portsmouth
Buckingham Building,
Lion Terrace,
Portsmouth (UK)
PO1 3HE
Email: omobolanle.omisade@port.ac.uk

Supervisor
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PO1 3HE
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If the concern or complaint is not resolved by the Principal Investigator or supervisor, you should contact the head of department Dr. Nick Savage, nick.savage@port.ac.uk. If the complaint remains unresolved, please contact the University Complaints Officer (02392 843642, complaintsadvice@port.ac.uk).

In the unlikely event that you become distressed as a result of taking part in this online study, we recommend that you seek support from the support forum you found this advert. Additional support can also be found via the contact details below.

**Pandas Support:** http://www.pandasfoundation.org.uk 08432898401  (PANDAS is the leading UK charity in supporting families suffering from pre (antenatal) and postnatal illnesses)

**MIND:** Mindinfoline 03001233393; info@mind.org.uk (MIND provides support in mental health)

**Big White Wall:** https://www.bigwhitewall.com  (A safe online community of people who are anxious, down or not coping who support and help each other by sharing what’s troubling them, guided by trained professionals.)
C. The perception of professional’s on PND interventions

C.1. Final Questionnaire

_The questions will ask you about the details of clients that you see_

1. In your day-to-day work, do you or have you in the past provided support for women with postnatal depression (PND)? (If No, END)

- [ ] Yes
- [ ] No

2. Approximately, how frequently would you see each client suffering from PND?


3. Approximately, how long would you normally spend with each client / patient on each support appointment?


4. In your view, do you think support appointments help improve compliance with treatments?

- [ ] Yes
- [ ] No

5. If yes, why?


6. What therapy (or therapies) do you normally use for clients / patients with PND?


7. What techniques of the therapy (or therapies) would you use for these clients?
8. What specific **techniques** would you say are effective for most of your clients / patient with PND?

9. What do you think are the benefits of the **techniques** to support PND effectively?

10. What do you think are the common problems of the techniques to support PND effectively?

11. Can any of the **techniques** used to support PND be practised at home?

12. If you answered yes to the question above do you think practising these techniques at home can potentially interfere with a woman’s daily activities
13. Here is a list of therapies that might have been used to help women with PND, please rate how useful you think each technique would be with the type of clients you see?

<table>
<thead>
<tr>
<th>Therapy</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td>Cognitive Behavioural Therapy</td>
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<tr>
<td>Monitoring and assistance (by a GP, Nurse or Therapist)</td>
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<tr>
<td>Medication</td>
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<td></td>
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<tr>
<td>Psycho-education and information</td>
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<tr>
<td>Self-help from peer group</td>
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<td>Interpersonal Therapy</td>
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<td>Well-being Therapy</td>
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<tr>
<td>Problem-solving Therapy</td>
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<tr>
<td>No treatment</td>
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</tbody>
</table>
14. How effective is the therapy that you find “definitely useful” in the previous question in addressing the following?

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Not applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>It can help to reduce their isolation</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>It can help them talk to other people</td>
<td>☐</td>
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<td>☐</td>
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<tr>
<td>It can help them prioritise demands on things they have to do</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>It can help them in the relationship with their children</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>It can help them reduce their stress</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<tr>
<td>It can help them to manage their negative thoughts</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>Agree</td>
<td>Neither agree nor Disagree</td>
<td>Disagree</td>
<td>Strongly disagree</td>
<td>Not applicable</td>
<td></td>
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<td><img src="image4" alt="Circle" /></td>
<td><img src="image5" alt="Circle" /></td>
<td><img src="image6" alt="Circle" /></td>
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</tr>
</tbody>
</table>

It can help them to have faith in themselves

15. Here is a list of **techniques** that might usefully help women with PND, please rate how useful you think each technique would be with the type of clients you see?

<table>
<thead>
<tr>
<th>Not at all useful</th>
<th>Rarely useful</th>
<th>Might be useful</th>
<th>Probably useful</th>
<th>Definitely useful</th>
<th>I do not know</th>
</tr>
</thead>
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<tr>
<td><img src="image7" alt="Circle" /></td>
<td><img src="image8" alt="Circle" /></td>
<td><img src="image9" alt="Circle" /></td>
<td><img src="image10" alt="Circle" /></td>
<td><img src="image11" alt="Circle" /></td>
<td><img src="image12" alt="Circle" /></td>
</tr>
</tbody>
</table>

Cognitive restructuring

<table>
<thead>
<tr>
<th>Distraction</th>
<th><img src="image13" alt="Circle" /></th>
<th><img src="image14" alt="Circle" /></th>
<th><img src="image15" alt="Circle" /></th>
<th><img src="image16" alt="Circle" /></th>
<th><img src="image17" alt="Circle" /></th>
<th><img src="image18" alt="Circle" /></th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Positive Reminiscing</th>
<th><img src="image19" alt="Circle" /></th>
<th><img src="image20" alt="Circle" /></th>
<th><img src="image21" alt="Circle" /></th>
<th><img src="image22" alt="Circle" /></th>
<th><img src="image23" alt="Circle" /></th>
<th><img src="image24" alt="Circle" /></th>
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</thead>
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<thead>
<tr>
<th>Focusing on the future</th>
<th><img src="image25" alt="Circle" /></th>
<th><img src="image26" alt="Circle" /></th>
<th><img src="image27" alt="Circle" /></th>
<th><img src="image28" alt="Circle" /></th>
<th><img src="image29" alt="Circle" /></th>
<th><img src="image30" alt="Circle" /></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Breathing techniques</th>
<th><img src="image31" alt="Circle" /></th>
<th><img src="image32" alt="Circle" /></th>
<th><img src="image33" alt="Circle" /></th>
<th><img src="image34" alt="Circle" /></th>
<th><img src="image35" alt="Circle" /></th>
<th><img src="image36" alt="Circle" /></th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Role transition</th>
<th><img src="image37" alt="Circle" /></th>
<th><img src="image38" alt="Circle" /></th>
<th><img src="image39" alt="Circle" /></th>
<th><img src="image40" alt="Circle" /></th>
<th><img src="image41" alt="Circle" /></th>
<th><img src="image42" alt="Circle" /></th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Writing about the issues</th>
<th><img src="image43" alt="Circle" /></th>
<th><img src="image44" alt="Circle" /></th>
<th><img src="image45" alt="Circle" /></th>
<th><img src="image46" alt="Circle" /></th>
<th><img src="image47" alt="Circle" /></th>
<th><img src="image48" alt="Circle" /></th>
</tr>
</thead>
</table>
16. Which ONE of these therapy delivery approaches do you think is MOST effective for recovery from postnatal depression? (Please choose one)

☐ Help from sessions with a therapist (such as GP, Psychologist)

☐ Help from home-visits from health care workers (such as Midwives, Support workers)

☐ Help from structured group sessions with other women suffering from postnatal depression

☐ Help from an online self-help program

☐ None of the above

☐ Other (Please specify)

17. How frequently do your clients normally have to use therapy before recovery from PND.

☐ Every day

☐ Every week

☐ Every 2-3 weeks

☐ Every month
18. How long do your clients tend to use therapy before recovery?

- [ ] Less than 6 months
- [ ] 6 months to less than 1 year
- [ ] 1 year to less than 2 years
- [ ] 2 years or more
- [ ] Not sure
The next questions will ask about using mobile apps to support PND

19. How often do you think your clients would use the following?

<table>
<thead>
<tr>
<th></th>
<th>Almost never</th>
<th>A few times</th>
<th>Sometimes</th>
<th>Often</th>
<th>Very frequently</th>
<th>I do not know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-help books</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Online self-help material</td>
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<tr>
<td>Homework between appointments</td>
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<tr>
<td>Alternative therapies</td>
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<tr>
<td>Phone a help line</td>
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<tr>
<td>Smart phone</td>
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</tbody>
</table>
20. If a mobile app was developed as an additional support for PND, how useful do you think it will be in relation to the following outcomes?

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Not useful at all</th>
<th>Rarely useful</th>
<th>Might be useful</th>
<th>Probably useful</th>
<th>Definitely useful</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>It could help clients practise techniques learnt (Such as coping techniques, attachment styles)?</td>
<td>[ ]</td>
<td>[ ]</td>
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<tr>
<td>It could help clients adhere to therapy (For example appointment reminders, medication reminders)</td>
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<tr>
<td>It could facilitate parenting practises (For example keeping track of infant feeding, sleep and other cues)</td>
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<tr>
<td>It could help clients engage in previously valued and meaningful activities</td>
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<tr>
<td>It could help facilitate clients to seek support from family or friends</td>
<td>[ ]</td>
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</tbody>
</table>
21. If a mobile app was developed as an additional support for PND, how concerned would you be about the following issues?

<table>
<thead>
<tr>
<th>Concern</th>
<th>Not useful at all</th>
<th>Rarely useful</th>
<th>Might be useful</th>
<th>Probably useful</th>
<th>Definitely useful</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>That the clients would get even more depressed using the app</td>
<td>☐</td>
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<tr>
<td>That the app would be too complex for the client</td>
<td>☐</td>
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<tr>
<td>That the client may think the app will replace appointments</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
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<tr>
<td>That the clients will not want to use such an app</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
</tbody>
</table>
22. If there was a mobile app that could facilitate one of the following, how useful do you think it might be?

<table>
<thead>
<tr>
<th>Cognitive restructuring</th>
<th>Not at all useful</th>
<th>Rarely useful</th>
<th>Might be useful</th>
<th>Probably useful</th>
<th>Definitely useful</th>
<th>I do not know</th>
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<th>Distraction</th>
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<th>Positive Reminiscing</th>
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<th>Focusing on the future</th>
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<th>Breathing techniques</th>
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<th>Role transition</th>
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<tr>
<th>Writing about the issues</th>
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<th>Improving communication</th>
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<tr>
<th>Improving relationships</th>
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<th>Activity Scheduling</th>
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23. What other issues might you be concerned about regarding a mobile app to support PND?
24. Do you have any suggestion to help inform the development of a mobile app to support PND?

25. The following are ways you might like to be further involved with this research. Please say yes to those you would like to be contacted in the future about— I would like to:

<table>
<thead>
<tr>
<th>Option</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>See a prototype of the app</td>
<td></td>
<td></td>
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<tr>
<td>Invite my clients to use the app</td>
<td></td>
<td></td>
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<tr>
<td>Help recruit participants</td>
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<tr>
<td>Give feedback on the app</td>
<td></td>
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<tr>
<td>Receive a copy of the overall results of this research</td>
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<td></td>
</tr>
</tbody>
</table>

26. Please indicate how you might like to be contacted (Email or Telephone number).

C.2. Participant information sheet

Researcher: Omobolanle Omisade
Email: omobolanle.omisade@port.ac.uk
Supervisor: Dr Alice Good
Email: alice.good@port.ac.uk

**Study Title: Professionals’ views of therapy, techniques and the use of mobile apps to support women with PND.**

I would like to invite you to take part in my research. You are under no obligation to participate and your choice will have no impact either positive or negative. Before you decide I would like you to understand why the research is being done and what it would involve for you. Please ask us if there is anything that is unclear.

We are looking for participants who have had experience with supporting women with postnatal depression to an interview on exploring views on the impact of therapy and use of mobile technology.

**What is the purpose of the study?**

The purpose of this study is to explore whether the use of mobile technology can serve as additional support and an intervention delivery technique for women with PND. In addition, this study aims to gain the opinion of professional on support techniques traditionally used for PND that could be adapted and implemented via mobile technology delivery techniques.

**Why have I been invited?**

You may have had previous experience of providing support for women with postnatal depression.

**Do I have to take part?**

No. It is up to you to decide to join the study as participation is voluntary and you could opt out at any stage of the study without any justification. The decision to withdraw will not affect you in any way or form. If you agree to take part, we will then ask you to sign an informed consent form.

**What will happen to me if I take part?**
If you decide to take part in this study, you will be required to be in an interview on any platform of your choice, which will last approximately 30-45 minutes. There will be a series of questions relating to your therapy and delivery approach. Some of the questions will explore your opinion on therapy and their techniques, and the use of mobile technology as an additional support for PND.

**What are the possible disadvantages and risks of taking part?**

There are no foreseeable risks or disadvantages associated with taking part in this study.

**What are the possible benefits of taking part?**

Although there are no direct benefits to you, the results of this study will contribute towards a better understanding of the modification of therapy that can be used to provide additional support for women with PND.

**Will my data be confidential?**

Your anonymous responses (raw data) will be kept securely by the Principal Investigator. In particular, the data will be stored electronically on a password protected computer. The data may be presented to others at research meetings, or published as a project report, academic dissertation, scientific paper or book, or in future research studies approved by an appropriate Faculty of Technology Ethics Committee of the University of Portsmouth.

Your responses (raw data) will not be passed to anyone outside the study team without your express written permission. The exception to this will be any regulatory authority, who may have the legal right to access the data for the purposes of conducting an investigation in exceptional cases. The raw data will be retained for 4 years following publication (in line with APA guidance). When it is no longer required, the data will be disposed of securely.

**What if there is a problem?**

If you have a concern about any aspect of this study, you should ask to speak to the research supervisor, who will do their best to answer your questions [details on page 1]. If you remain unhappy and wish to complain formally, you may contact:
Head of School.
Dr Nick Savage.
Email: nick.savage@port.ac.uk

**Who is organising and funding the research?**

This research is self-funded by the researcher (Omobolanle Omisade). None of the researchers or study staff will receive any financial reward for conducting this study.

**How can I contact researcher if I have any further questions?**

Researcher
Omobolanle Omisade
School of Computing
University of Portsmouth
Buckingham Building,
Lion Terrace,
Portsmouth (UK)
PO1 3HE
Email: omobolanle.omisade@port.ac.uk

Supervisor
Dr Alice Good
School of Computing
University of Portsmouth
Buckingham Building,
Lion Terrace,
Portsmouth (UK)
PO1 3HE
Email: alice.good@port.ac.uk

Thank you for taking time to read this information sheet and for considering volunteering for this study. If you do volunteer for this study your consent will be sought on the following page. If you wish to retain a copy of your informed consent, please print the relevant page before continuing to the survey.
C.3. Consent form

Researcher: Omobolanle Omisade
Email: omobolanle.omisade@port.ac.uk
Supervisor: Dr Alice Good
Email: alice.good@port.ac.uk

Study Title: Professionals’ views of therapy, techniques and the use of mobile apps to support women with PND.

1. I confirm that I have read and understood the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.
3. I understand that data collected during the study, may be looked at by individuals from the University of Portsmouth, or from regulatory authorities. I give permission for these individuals to have access to my data.
4. I understand that the results of this study may be published and/or presented at meetings and conferences. I give my permission for my anonymous data, which does not identify me, to be disseminated in this way.
5. I agree to the data I contribute being retained for future research.
6. I agree to take part in the above study.

In addition, please be aware that by participating in the interview you are implicitly providing consent.
C.4. Debrief form

Researcher: Omobolanle Omisade
Email: omobolanle.omisade@port.ac.uk
Supervisor: Dr Alice Good
Email: alice.good@port.ac.uk

Study Title: The views of mothers with previous diagnosis of postnatal depression on the impact of therapy and use of mobile technology

Thank you for taking part in this study.
Mobile technology could be an opportunity to offer mothers suffering from postnatal depression additional and ‘just-in-time’ support. This research is a study to elicit views from mothers with a previous diagnosis of PND, to provide an understanding of the aspects of intervention that are important to women with PND.
The result of the study will be used to develop a set of principles in form of requirements that could be used to inform the development of mobile technologies which may provide additional support to therapies postnatal mothers receive.
Once again thank you for your participation, it is greatly appreciated. If you are interested in the results of the study, have questions concerning your participation or would like to withdraw your data, please contact

Researcher
Omobolanle Omisade
School of Computing
University of Portsmouth
Buckingham Building,
Lion Terrace,
Portsmouth (UK)
PO1 3HE
Email: omobolanle.omisade@port.ac.uk

Supervisor
Dr Alice Good
School of Computing
University of Portsmouth
Buckingham Building,
Lion Terrace,
Portsmouth (UK)
PO1 3HE
Email: alice.good@port.ac.uk

If the concern or complaint is not resolved by the Principal Investigator or supervisor, you should contact the head of department Dr. Nick Savage, nick.savage@port.ac.uk
If the complaint remains unresolved, please contact the University Complaints Officer (02392 843642, complaintsadvice@port.ac.uk).
D. Professionals’ views of an adjunct mobile application to improve adherence to treatment in women with postnatal depression.

D.1. Final Questionnaire

The first set of questions will be asked before the link to the mobile application is presented

The questions will ask you about the details of clients that you see

1. In your day-to-day work, do you or have you in the past provided support for women with postnatal depression (PND)? (If No, END)
   
   ☐ Yes ☐ No

2. Approximately, how frequently would you see each client suffering from PND?

3. Approximately, how long would you normally spend with each client / patient on each support appointment?

The next set of questions will be asked after participants have interacted with the mobile application

This section explores your interaction with the mobile application

Question 1 will be used to evaluate the degree of adherence if the mobile application is used.

4. Do you think the mobile application could increase adherence to PND treatment?

5. Do you think the mobile application could improve long-term sustained treatment outcome?

6. Do you think using the mobile application could keep users supported between different therapeutic sessions?

7. Do you think using the mobile application would help users self-manage their wellbeing effectively?

Question 5 will be used to evaluate the outcome of women managing their responsibilities to other members of their family and friends.

8. Thinking about the features of the mobile application, do you think using it could potentially benefit those who live and work with users?

Question 6 is asked to elicit professionals’ thoughts on what other practitioners might think

9. Would other practitioners think that the mobile application is useful?
   Strongly disagree: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree

Question 7 is asked to elicit their personal thoughts

10. Thinking about the kind of support you provide, do you think women with postnatal depression should use the proposed mobile application?
    Strongly disagree: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree
Please state the reason for your answer to the above question.

Number 8 is asked to measure the power of the control factors

11. To what extent do you think being offered the mobile application by practitioners would make it easier for women to adhere to treatment?

12. If motivated, most women with postnatal depression will use the adjunct mobile application
   Strongly disagree: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree

Question 10 is a check question

13. How important do you think it is to self-manage wellbeing effectively?
   Not important: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Very important

14. Thinking about my clients, I expect that women would use the mobile application for at least once a week in during the first 12 months of recovering from PND.

Question number 12 will identify if the mobile application will facilitate reduced cost of providing PND treatments.

15. Do you think using the mobile application can potentially reduce the cost of ensuring adherence and PND treatment outcome?

Question number 13 will identify if the mobile application will facilitate reduced number of support sessions that are given.
16. Do you think using the mobile application can potentially allow treatment sessions to be offered at a reduced frequency?


*Question number 14 will identify if the mobile application will facilitate reduced treatment duration of each support session given.*

17. Do you think using the mobile app can potentially allow treatment session to be offered at reduced duration?


*Question number 15 will identify if childcare will be a barrier to using the mobile application.*

18. I am confident that childcare will not interfere with using the mobile application

Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree

*Question number 16 will identify if the mobile application will facilitate prioritising the women’s demands and managing their overwhelming responsibilities.*

19. From my interaction with the mobile application, women would be able to manage overwhelming responsibilities by using the app.

Strongly disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree

The following questions are going to ask about the benefits of the features of the mobile app that will help bridge the gap between motivation and action.

*Question number 17 will identify if the self-incentives feature of the mobile application will motivate the performance of adherence behaviour.*

20. Do you think the self-incentives feature in the mobile app will be helpful?

Strongly disagree: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree
Question number 18 will identify if the health information feature of the mobile application will motivate the performance of adherence behaviour.

21. Do you think the health information feature in the mobile app will be helpful?

Strongly disagree: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree

Question number 19 will identify if the self-completion feature of the mobile application will motivate the performance of the behaviour.

22. Do you think the self-completion plan will cue women to engage in adherence behaviour?

Strongly disagree: 1 : 2 : 3 : 4 : 5 : 6 : 7 : Strongly agree

Question number 20 will identify their thoughts on incentives.

23. What are your views on how effective incentivising is on intervening with long-term sustainability?

24. Are you aware of any mobile applications that are designed to support people with ‘self-managing PND or could be used?

Yes

No

If you have indicated ‘yes’ to the above question, please describe

25. Would you recommend AbovePND mobile application to your clients?

Yes

No
If you have indicated ‘yes’ to the above question, please state why

If you have indicated ‘no’ to the above question, please state why

26. What are your preferred characteristics of incentives?

27. I think that users would use the mobile application frequently

   Strongly disagree: 1 : 2 : 3 : 4 : 5 Strongly agree

28. I found the mobile application complex?

   Strongly disagree: 1 : 2 : 3 : 4 : 5 Strongly agree

29. I thought the mobile application was easy to use

   Strongly disagree: 1 : 2 : 3 : 4 : 5 Strongly agree

30. I think that users would need the support of a technical person to be able to use this mobile application

   Strongly disagree: 1 : 2 : 3 : 4 : 5 Strongly agree

31. I found the various function in this mobile application well integrated
32. I thought there were too many inconsistencies in the mobile application.
   
   **Strongly disagree: 1 : 2 : 3 : 4 : 5. Strongly agree**

33. I would imagine that users would learn how to use the mobile application very quickly.

   **Strongly disagree: 1 : 2 : 3 : 4 : 5. Strongly agree**

34. Users will find the mobile application very cumbersome to use.

   **Strongly disagree: 1 : 2 : 3 : 4 : 5. Strongly agree**

35. Users will be very confident that using mobile application what? Word(s) missing.

   **Strongly disagree: 1 : 2 : 3 : 4 : 5. Strongly agree**

36. Users will need to learn a lot of things before using the mobile application.

   **Strongly disagree: 1 : 2 : 3 : 4 : 5. Strongly agree**
D.2. Participant information sheet

Researcher: Omobolanle Omisade
Email: omobolanle.omisade@port.ac.uk
Supervisor: Dr Alice Good
Email: alice.good@port.ac.uk

Study Title: Professionals’ views of an adjunct mobile app to improve adherence to treatment in women with postnatal depression.

Thank you for your time. I am a PhD student looking for professional who have experience in providing support / treatment for women with postnatal depression (PND).

I would like to invite you to take part in my research study. First of all I would provide you with the developed mobile app. After that, you will be required to complete a survey which will last approximately 30-35 minutes.

It is entirely up to you whether you participate but your responses would be valued. This study aims to identify whether the mobile app could improve adherence to treatment in women with postnatal depression. The objectives are to test whether the mobile app will help increase adherence, sustain treatment effect and wellbeing. We will also identify the deficiencies of the app and facilitate redesign to overcome its deficiencies. Finally we will identify the completeness and relevance as well as the extent to which the app functions properly.

All reasonable steps will be taken to ensure confidentiality and responses from the survey will be collated for analysis. The analysis will ensure that data is anonymous and once this is complete the original responses will be stored for a minimum of 4 years and then destroyed. If you wish to participate in this study please contact omobolanle.omisade@port.ac.uk or reply to this message.

You are under no obligation to participate and your choice will have no impact either positive or negative. Before you decide I would like you to understand why the research is being done and what it would involve for you. Please ask us if there is anything that is unclear.
We are looking for participants who have had experience with supporting women with postnatal depression to an interview on exploring views on the impact of therapy and use of mobile technology.

What is the purpose of the study?

The purpose of this study is to explore whether the use of mobile technology can serve as additional support and an intervention delivery technique for women with PND. In addition, this study aims to gain the opinion of professional on support techniques traditionally used for PND that could be adapted and implemented via mobile technology delivery techniques.

Why have I been invited?

You may have had previous experience of providing support for women with postnatal depression.

Do I have to take part?

No. It is up to you to decide to join the study as participation is voluntary and you could opt out at any stage of the study without any justification. The decision to withdraw will not affect you in any way or form. If you agree to take part, we will then ask you to sign an informed consent form.

What will happen to me if I take part?

If you decide to take part in this study, you will be required to be in an interview on any platform of your choice, which will last approximately 30-45 minutes. There will be a series of questions relating to your therapy and delivery approach. Some of the questions will explore your opinion on therapy and their techniques, and the use of mobile technology as an additional support for PND.

What are the possible disadvantages and risks of taking part?

There are no foreseeable risks or disadvantages associated with taking part in this study.

What are the possible benefits of taking part?
Although there are no direct benefits to you, the results of this study will contribute towards a better understanding of the modification of therapy that can be used to provide additional support for women with PND.

**Will my data be confidential?**

Your anonymous responses (raw data) will be kept securely by the Principal Investigator. In particular, the data will be stored electronically on a password protected computer. The data may be presented to others at research meetings, or published as a project report, academic dissertation, scientific paper or book, or in future research studies approved by an appropriate Faculty of Technology Ethics Committee of the University of Portsmouth.

Your responses (raw data) will not be passed to anyone outside the study team without your express written permission. The exception to this will be any regulatory authority, who may have the legal right to access the data for the purposes of conducting an investigation in exceptional cases. The raw data will be retained for 4 years following publication (in line with APA guidance). When it is no longer required, the data will be disposed of securely.

**What if there is a problem?**

If you have a concern about any aspect of this study, you should ask to speak to the research supervisor, who will do their best to answer your questions [details on page 1]. If you remain unhappy and wish to complain formally, you may contact:

Head of School.
Dr Nick Savage.
Email: nick.savage@port.ac.uk

**Who is organising and funding the research?**

This research is self-funded by the researcher (Omobolanle Omisade). None of the researchers or study staff will receive any financial reward for conducting this study.

**How can I contact researcher if I have any further questions?**

Researcher
Thank you for taking time to read this information sheet and for considering volunteering for this study. If you do volunteer for this study your consent will be sought on the following page. If you wish to retain a copy of your informed consent, please print the relevant page before continuing to the survey.

**D.3. Consent form**

Researcher: Omobolanle Omisade  
Email: omobolanle.omisade@port.ac.uk  
Supervisor: Dr Alice Good  
Email: alice.good@port.ac.uk  

*Study Title: Professionals’ views of an adjunct mobile app to improve adherence to treatment in women with postnatal depression.*
1. I confirm that I have read and understood the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

3. I understand that data collected during the study, may be looked at by individuals from the University of Portsmouth, or from regulatory authorities. I give permission for these individuals to have access to my data.

4. I understand that the results of this study may be published and/or presented at meetings and conferences. I give my permission for my anonymous data, which does not identify me, to be disseminated in this way.

5. I agree to the data I contribute being retained for future research.

6. I agree to take part in the above study.

In addition, please be aware that by completing the questionnaire you are implicitly providing consent.
D.4.  Debrief form

Researcher:  Omobolanle Omisade
Email: omobolanle.omisade@port.ac.uk
Supervisor:  Dr Alice Good
Email: alice.good@port.ac.uk

Study Title: Professionals’ views of an adjunct mobile app to improve adherence to treatment in women with postnatal depression.

Thank you for taking part in this study.
Mobile technology could be an opportunity to offer mothers suffering from postnatal depression additional and ‘just-in-time’ support. This research is a study to elicit views from mothers with a previous diagnosis of PND, to provide an understanding of the aspects of intervention that are important to women with PND.
The result of the study will be used to develop a set of principles in form of requirements that could be used to inform the development of mobile technologies which may provide additional support to therapies postnatal mothers receive.
Once again thank you for your participation, it is greatly appreciated. If you are interested in the results of the study, have questions concerning your participation or would like to withdraw your data, please contact

Researchers
Omobolanle Omisade
School of Computing
University of Portsmouth
Buckingham Building,
Lion Terrace,
Portsmouth (UK)
PO1 3HE
Email: omobolanle.omisade@port.ac.uk

Supervisor
Dr Alice Good
School of Computing
University of Portsmouth
Buckingham Building,
Lion Terrace,
Portsmouth (UK)
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Email: alice.good@port.ac.uk

If the concern or complaint is not resolved by the Principal Investigator or supervisor, you should contact the head of department Dr. Nick Savage, nick.savage@port.ac.uk
If the complaint remains unresolved, please contact the University Complaints Officer (02392 843642, complaintsadvice@port.ac.uk).
E. Details of support groups contacted for studies in this research

All of the following are UK based online support groups:

1. House of light
2. Mothers for Mothers
3. Post Natal Illness (PNI)
4. MIND
5. PANDAS
6. Action on postpartum
7. Netmums
8. NCT
9. Mumsnet
10. Baby Centre
11. Fertility Friend (UK)
12. Postnatal Depression Hampshire

Moderators of the afore mentioned groups were consulted with regards to the research, prior to actively targeting potential participants. Once approval had been granted, recruitment involved voluntary participation of respondents. In addition to online support forums the following Facebook groups were used:

13. Postnatal Wellness and Support (86 members)
14. Above the blues supporting postnatal depression (47 members)
15. Postnatal support (1078 members)
16. Postnatal Depression Awareness (2,648 members)
17. Postpartum depression support group for past present and future survivors (711 members)
18. Anxiety disorder unite (21,187 members)
19. Action on postpartum APP (1,211 members)
20. Butterflies on rainbows support group for the loss of a child (162 members)
21. Postnatal depression support network (161 members)
22. PANDAS (5473 members)
23. Through the blues (1,473 members)
24. Postpartum progress (19,701 members)
25. MIND (197,743 members)
26. Defeat Depression (307,167 members)
27. Wellness for women (6277 members)
28. Brighter days for mums (7377 members)
29. The Joanne Bingley Memorial Foundation (875 members)
30. Post Partum Depression and Support (1041 members)
31. Postnatal depression support group (193 members)
32. Postnatal depression and Anxiety support Portsmouth (208 members)
33. Postnatal depression support group (PND) (28 members)
34. Postnatal depression awareness and support (53 members)
35. Postnatal depression awareness and support Scotland (216 members)
36. Daisy Chains - Postnatal Depression support network
37. Post Natal Depression
38. Post Natal Depression You are NOT Alone (102 members)
39. A New Day Peer Support Group for Moms with Postpartum Depression (129)
40. Beyond the Birth Postpartum Depression Group (40)
41. Postpartum Depression Help and Awareness (33)
42. Postpartum Depression and Postnatal Mood Disorders (56)
43. Surviving Postpartum Depression (53)
44. Postpartum Depression Awareness It takes a Village (56)
45. Postpartum Depression, Anxiety, Birth Trauma, and Post Natal PTSD Survivors (191)
46. Postpartum Depression to Joy (285)
47. Hope for Postpartum Depression
48. POSTNATAL DEPRESSION SUPPORT TEAM(straight out... off it.).
49. Postnatal depression Brighton & hove.
50. Post-Natal Depression Support Group Wexford
51. Babybumps Postnatal Depression Support Group
52. Postpartum Depression and Postnatal Challenges (28)
53. Pandas Foundation (Pre And PostNatal Depression Advice and Support)
54. Online CBT for Postnatal Depression in association with Netmums UK.
55. Post-natal depression york uk
56. Postnatal Depression - Isle of Man
57. Postnatal Depression support group Derbyshire
58. Postnatal Depression Support Team
59. Postnatal Depression Wales
60. Having A Baby After A PPMD - Support Group.
61. Pink & Blue. Sufferers and Survivors of post natal depression
62. Help us create awareness for Postnatal Depression

Postnatal depression support

Approvals were be sought from the administrators before posting to Facebook groups or Facebook "pages". For moderated groups, consent were obtained from the manager/moderator by sending a message explaining the research, what help was needed and including the full questionnaire and participant information. The invitation were appropriately amended according to the individual groups.
F. PND support resources

Given the possibility, that participants may incur psychological stress in relation to carrying out the survey, information has been provided at the end of the survey, advising participants where they can seek support from the following contacts:

**Pandas Support**: http://www.pandasfoundation.org.uk 08432898401 (PANDAS is the leading UK charity in supporting families suffering from pre (antenatal) and postnatal illnesses)

**MIND**: Mindinfoline 03001233393; info@mind.org.uk (MIND provides support in mental health)

**Big White Wall**: https://www.bigwhitewall.com (A safe online community of people who are anxious, down or not coping who support and help each other by sharing what’s troubling them, guided by trained professionals.

Furthermore, participants are advised, should they require it, to seek support from the support forum they found the advert for the research.
G. Mobile application development codes

```java
public class MainActivity extends AppCompatActivity implements LoaderManager.LoaderCallbacks<Cursor> {

    private FloatingActionButton mAddReminderButton;
    private Toolbar mToolbar;
    AlarmCursorAdapter mCursorAdapter;
    AlarmReminderDbHelper alarmReminderDbHelper = new AlarmReminderDbHelper(this);
    ListView reminderListView;
    ProgressDialog progDialog;

    private static final int VENICLE_LOADER = 0;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        mToolbar = (Toolbar) findViewById(R.id.toolbar);
        setSupportActionBar(mToolbar);
        getSupportActionBar().setTitle("Above Postnatal Depression");

        reminderListView = (ListView) findViewById(R.id.list);
        View emptyView = findViewById(R.id.empty_view);
        reminderListView.setEmptyView(emptyView);

        mCursorAdapter = new AlarmCursorAdapter(this, null);
        reminderListView.setAdapter(mCursorAdapter);

        reminderListView.setOnItemClickListener((adapterView, view, position, id) -> {
            Intent intent = new Intent(
                    packageContext, MainActivity.this, AddReminderActivity.class);
            startActivity(intent);
        });
    }
}
```
public void onClick(View view) {
    if (view == findViewById(R.id.btnSave)) {
        TreatmentRepo repo = new TreatmentRepo();
        Treatment treatment = new Treatment();
        treatment.editTextTreatmentNumber = Integer.parseInt(editTextTreatmentNumber.getText().toString());
        treatment.editTextTreatmentType = editTextTreatmentType.getText().toString();
        treatment.editTextTreatmentName = editTextTreatmentName.getText().toString();
        treatment.treatment_ID = treatment_ID;
        if (treatment_ID != 0) {
            repo.insert(treatment);
            Toast.makeText(this, "New Treatment Insert", Toast.LENGTH_SHORT).show();
        } else {
            repo.update(treatment);
            Toast.makeText(this, "Treatment Record updated", Toast.LENGTH_SHORT).show();
        }
    }
}

@Override
public boolean onCreateOptionsMenu(Menu menu) {
    // Inflate the menu; this adds items to the action bar if it is present.
    MenuInflater inflater = getMenuInflater();
    inflater.inflate(R.menu.menu, menu);
    return super.onCreateOptionsMenu(menu);
}

@Override
public boolean onOptionsItemSelected(MenuItem item) {
    switch (item.getItemId()) {
    case R.id.details:
        Intent regIntent = new Intent(getApplicationContext(), TreatmentInstructions.class);
        startActivity(regIntent);
        break;
    case R.id.manageSymptoms:
        Intent objIntent = new Intent(getApplicationContext(), Monitor_symptoms.class);
        startActivity(objIntent);
        break;
    case R.id.addPND:
        Intent infoIntent = new Intent(getApplicationContext(), PNDInformation.class);
        startActivity(infoIntent);
        break;
    case R.id.addFriend:
        Intent addFriendIntent = new Intent(getApplicationContext(), AddFriend.class);
        startActivity(addFriendIntent);
        break;
    default:
        return super.onOptionsItemSelected(item);
    }
    return true;
}
```java
public void onClick(View v) {
    if (v.getId() == R.id.btnSave) {
        TreatmentRepo repo = new TreatmentRepo(context); 
        Treatment treatment = new Treatment();
        editTextTreatName = findViewById(R.id.editTextTreatmentName);
        editTextTreatType = findViewById(R.id.editTextTreatmentType);
        editTextTreatNumber = findViewById(R.id.editTextTreatmentNumber);
        btnSave = (Button) findViewById(R.id.btnSave);
        btnSave.setOnClickListener(this);
        int treatmentNumber = Integer.parseInt(editTextTreatNumber.getText().toString());
        String treatementType = editTextTreatType.getText().toString();
        String treatementName = editTextTreatName.getText().toString();
        treatment.setEditTextTreatNumber(treatmentNumber);
        treatment.setEditTextTreatName(treatmentName);
        treatment.setEditTextTreatType(treatmentType);
        if (treatment != null) {
            repo.insert(treatment);
            Toast.makeText(context, "Treatment Instructions Saved", Toast.LENGTH_SHORT).show();
            startActivity(new Intent(packageContext, MainActivity.class));
        } else {
            Toast.makeText(context, "Could not save Treatment Instructions ", Toast.LENGTH_SHORT).show();
            startActivity(new Intent(packageContext, Monitor_symptoms.class));
        }
    } else if (v.getId() == R.id.btnDelete) {
        TreatmentRepo repo = new TreatmentRepo(context);
        repo.delete(_treatment_id);
        Toast.makeText(context, "Treatment instruction deleted", Toast.LENGTH_SHORT);
        finish();
    }
```
H. UPR16

**FORM UPR16**
Research Ethics Review Checklist

Please include this completed form as an appendix to your thesis (see the Postgraduate Research Student Handbook for more information)

<table>
<thead>
<tr>
<th>Postgraduate Research Student (PGRS) Information</th>
<th>Student ID:</th>
<th>493263</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGRS Name:</td>
<td>Omoseunde Omisade</td>
<td></td>
</tr>
<tr>
<td>Department:</td>
<td>SDC</td>
<td></td>
</tr>
<tr>
<td>First Supervisor:</td>
<td>dr alice good</td>
<td></td>
</tr>
<tr>
<td>Start Date:</td>
<td>(or progression date for Prof Doc students)</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Study Mode and Route:</th>
<th>Part-time</th>
<th>MPhil</th>
<th>MD</th>
</tr>
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<td>Full-time</td>
<td>[x]</td>
<td>PhD</td>
<td>[x]</td>
</tr>
<tr>
<td>Professional Doctorate</td>
<td>[ ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Title of Thesis: | Theory based development of a mobile application model to support the wellbeing and information needs of women with postnatal depression |
| Thesis Word Count: | 6843 |

If you are unsure about any of the following, please contact the local representative on your Faculty Ethics Committee for advice. Please note that it is your responsibility to follow the University’s Ethics Policy and any relevant University, academic or professional guidelines in the conduct of your study.

Although the Ethics Committee may have given your study a favourable opinion, the final responsibility for the ethical conduct of this work lies with the researcher(s).

**UKRIO Finished Research Checklist:**
(If you would like to know more about the checklist, please see your Faculty or Departmental Ethics Committee rep or see the online version of the full checklist at: http://www.ukrio.org/ukri/ukrio-duty-of-care-form-research)

a) Have all of your research and findings been reported accurately, honestly and within a reasonable time frame? | YES | [ ] |

b) Have all contributions to knowledge been acknowledged? | YES | [ ] |

c) Have you complied with all agreements relating to intellectual property, publication and authorship? | YES | [ ] |

d) Has your research data been retained in a secure and accessible form and will it remain so for the required duration? | YES | [ ] |

e) Does your research comply with all legal, ethical, and contractual requirements? | YES | [ ] |

**Candidate Statement:**
I have considered the ethical dimensions of the above named research project, and have successfully obtained the necessary ethical approval(s)

**Ethical review number(s) from Faculty Ethics Committee (or from NRES/SCREG):**
801 002, 803

If you have not submitted your work for ethical review, and/or you have answered ‘No’ to one or more of questions a) to e), please explain below why this is so:

**Signed (PGRS):**

**Date:**

UPR16 – August 2015