Supporting Childbirth Knowledge Acquisition and Decision-making through Digital Communication Technology: The Research Design of an Ongoing Study following a Mixed-Method Approach

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Abstract: This paper describes the research design of an ongoing study that overlaps three main fields: technology, health, and social science. This transdisciplinarity approach naturally brings challenges to the methodological plan, which this paper presents, and aims to guide the creation, validation and evaluation of a digital decision aid, and its comparison to a paper-based solution. Through the data collection from different natures, it is expected to be possible to understand the different sources, channels and formats of content that can contribute for childbirth knowledge acquisition; if communication can be facilitated between expectant parents, health care professionals, and childbirth educators; and ultimately, if the tool could provide a mean to create a document regarding birth preferences.

1 INTRODUCTION

Maternal Care is being highlighted in the political agenda for the past decades (United Nations, 2015a, 2015b); however, researchers report general gaps in antenatal care, a lack of communication and educational activities, and underline its importance and impact in mental health during postnatal, not just for the women who were pregnant, but for both expectant parents (Suto, Takehara, Yamane, & Ota, 2016). There are several Childbirth Educational Programs implemented in most western countries (Barimani, Frykedal, Rosander & Berlin, 2017) aspiring to add an educational component to care, which can be individual or in group, clinical-, home-, internet-, telephone-, or pamphlet-based, or even the combination of several approaches (Suto et al., 2016). Its goals vary nationally and internationally, but a common goal is to strengthen, support and help expectant parents for childbirth and parenting, in order to deal with this imminent major life transition, that can be confusing and overwhelming (Barimani, Vikstrom, Rosander, Frykedal, & Berlin, 2017). Expectant parents have been also using digital technologies for information and support (Huberty, Dinkel, Beets, & Coleman, 2013), giving differentiated uses according to successive digital technology eras. They searched for information in pregnancy related websites and blogs, and interacted through discussion forums (Doty & Dworkin, 2014), and with the advent of diverse new digital media, social web and mobile ubiquitous computing devices they expanded their use, culminating in the access to a wide range of products and services by mobile devices (Thomas & Lupton, 2015).

It is known that expectant parents seek information from a variety of sources and formats (Wallwiener et al., 2016), but there is some controversy, or possibly a tendency of change of behaviour over time, about the ideal option. According to Grimes, Forster, and Newton (2014) study, expectant mothers prefer electronic information over printed materials, with the last ones being regarded as unhelpful since women do not take the time to properly review their content. On the other hand, Hawley, Janamian, Jackson, and Wilkinson

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(2014) research reports that most pregnant women preferred to have paper-based health information to easily access and show to relatives, not only with educational proposes, but also to engage their relatives in the pregnancy experience.
Since there is no unique solution, in order to embrace different preferences (paper, oral and digital) and different needs (search, share, carry with them, etc.) in addition to show healthcare related dummies and accessories and to offer printed materials to expectant parents, healthcare professionals and childbirth educators could recommend online courses and digital materials aiming: a) autonomous learning, since it is considered a significant skill in current times (Freitas, Leite, de Souza, & Costa, 2019); b) to explore new scenarios of interactive, digital mediated and distance education; c) to promote informed-decision making among expectant parents.

Under the scope of the above-described scenario, and taking in consideration the Portuguese current context: antenatal classes are being tutored all over the country, however only few hospitals advocate birth plan's usage, since its regulation is still under discussion (GPPS, 2018); this ongoing study intends to explore an innovative educational approach, to understand the benefits and disadvantages of using digital technology in knowledge acquisition and in the informed decision-making process regarding childbirth preferences, in comparison to printed materials, since it seems to exist a gap in the literature. Carefully thinking the research design is of utmost importance since this study overlaps social, health and technology research fields, which naturally deal with different theories, techniques, approaches, settings and data types, what could be a limitation of the study and affect dramatically the results. However, it also opens the possibility to explore borders and blinders (Fetters & Freshwater, 2015).

2 MIXED METHODS APPROACH

After carefully analysing the problem, this research was framed in the Socio-critical paradigm (Anguera Argilaga, 1985; Habermas, 1974), as it will follow the tendency of Mixed Methods (Creswell & Plano Clark, 2018; Latorre, Rincon, & Arnal, 1996; Solomon, 1991).

This Mixed Method approach can be better understood when analysing the different phases that will be conducted (Figure 1). The research is a transversal study in what concerns the temporal scope, planned to start as exploratory during Phase 1, followed by activities of Research and Development as Phase 2 (Gajbhiye & Prasad, 2013), and then followed by a quasi-experimental approach as Phase 3 (Bisquerra Alzina, 1989), see Figure 1.

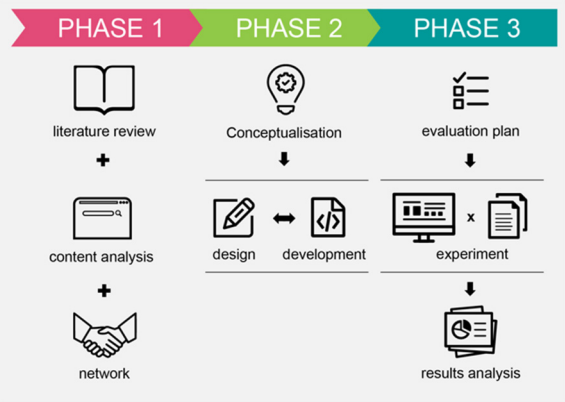

Figure 1: Research plan design, by Phase.

Phase 1 started with the literature review in order to: understand the current approaches to health education; explore the extent of maternal education in Portugal; comprehend the social acceptance of informed decisions for birth; understand what influences the preferences of pregnant women. This initial study helped to identify the current gap and formulate the research question:

How can a digital tool support the informed decision-making of pregnant women regarding birth preferences?

In addition, a Content Analysis was planned, starting by the identification of online tools for birth plans creation, so categories of data would emerge (Bardin, 2008; Ghiglione & Matalon, 1997). The results would contribute for the establishment of the information architecture of the digital resource.

Partnerships are of utmost importance allowing to frame the research in a network, which, besides amplifying its magnitude, can also provide extremely important resources, namely expedite access to participants for the study, so during Phase 1 relevant institutions were identified and contacts were established.

Besides searching for an answer to the research question that guided this mixed methods approach (Tashakkori & Creswell, 2007), and to discover and understand the reality, one of the main goals of this study is having an explicitly practical outcome by contributing to understand the relevance of digital media in the maternal health education, which can represent a turning point for healthcare promotion and outreach.

Therefore, the study includes Research and Development tasks during Phase 2, in order to conceptualize and create a proof of concept of a digital tool, which intends to, simultaneously, provide evidence-based information, and enable the creation of a birth plan according to each pregnant person preferences. Those tasks include the definition of the extent of the proposal considering feasibility, usability and accessibility factors; the specification of functional requirements; the content creation based on WHO guidelines (WHO, 2016; 2018) and expert's validation; defining the approach to integrate the content with the decision aids tool; establishing the design concept, in order to design interfaces and interactions; and finally, implement the digital tool using final technologies.

In Phase 3, aiming to evaluate the digital tool proposal, an experiment will be conducted, and to prepare it, the main tasks defined are: the creation, adaptation and experts' validation of instruments for data collection; the preparation of a controlled setting, and selecting and contacting participants.

A convenience sample will be used and participants will be split up into two groups: Control Group A will explore only printed materials, and the Experimental Group will explore the digital resources; both using the same created contents but adapted to the different formats. The distribution criteria between the two groups to guarantee the maximum possible homogeneity will be gestational weeks, and score on the digital literacy questions.

The contact of the participants will be gathered through a partner of this study, a Portuguese Public Health Centre. As inclusion criteria to participate in the study, it was established: expectant mothers, with pregnancies ranging from 20 to 37 weeks, that enrolled as a participant on the antenatal classes provided by the health centre as already stated, a partner of this study. They will be contacted by the phone, and requested to answer a short questionnaire with recruitment and selection purposes (QR), so it is related to the exclusion criteria: a) under 18 years old; b) non-European Portuguese native speaker; c) to carry a high risk pregnancy; d) to have or have had health issues or complications for herself during pregnancy or for the foetus; e) gestation under 20 or over 37 weeks; f) previous gestation above 12 weeks; g) psychiatric patient before or during pregnancy; h) to have clinical issues regarding memory and cognition; i) under 12th grade of qualification; j) have participated in any formal course, online or in person, regarding childbirth; k) low digital literacy. A total of 15 questions following auto-report approach, with 3 of them particularly aiming to calculate a score regarding their digital literacy, based on DIGCOMP scale (Vuorikari, Punie, Carretero Gomez & Van den Brande, 2016), but using a set of proposed questions. Targeting Level 2 or above (out of 8) aims to exclude the participants who necessarily need guidance to use digital technology, specifically when using Computers and Mobile devices, and Internet.

Only the ones eligible will be invited to participate in the experiment that will be scheduled individually, in person. It is believed that no relevant selection bias will occur, nevertheless the non-randomization factor will be taken in consideration while analysing the results.

The target number of participants for the next phase is around 30. There is a 7 weeks' window to conduct the test: the pregnant person can apply to join the antenatal classes until they reach 21 weeks of gestation, and the course will start when they around 28 weeks. The recruitment phase will be repeated until the target number is reached.

That second contact with the participants will be in person, and it will start by requesting them to answer a first questionnaire (Q1), in digital format and by self-completion, and Likert scales will play a major role for self-assessment questions. It includes six groups of questions regarding: socio-demographic, regarding the pregnant person and the partner; clinical factors; birth information that were already exposed, orally, on paper and digital formats; expectations of a tool for learning and to list preferences regarding birth.

Then the study follows a Pretest-Posttest Design: before and after testing the digital tool, or paper based for the Control Group A, the participants will be requested to answer the same questionnaire (QPPF, standing for Pre, Post and Follow-up), and they can not check nor change their previous answers. This study design (Figure 2) is widely used to compare different groups and measure behavioural changes regarding the experimental intervention (Dimitrov & Rumrill, 2003). It is also used in Educational models to assess students' outcome, even in self-learning students, being the instruction period the intervention (Sumner & Capano, 2010). In this study, this design will allow to analyse the changes on their birth preferences after exposed to the content and the individual learning outcomes. This questionnaire is focused on collecting data regarding: knowledge, influential factors, autonomy and self-relevance regarding pregnancy and birth; perception of credibility of different sources of information.

The test will be conducted by asking two groups to perform guided-tasks in a controlled environment. Kaikkonen et al. (2008) study shows that important

results can be achieved through laboratory tests, even in settings when the cognitive load from using digital devices could be an issue. The preparation of the environment to simulate a real situation is highly recommended, and the complexity of real usage needs to be foreseen and reflected on the tasks guide. A printed guide will be handle to each participant, which lists a set of numbered tasks to be performed, and clarifies that they should be autonomous, despite the fact that a thinking-aloud protocol is being followed (Boren & Ramey, 2000) and they under observation - direct and structured by using a behaviour schedule and keeping it as discrete as possible to avoid Hawthorne effect (McLeod, 2015).

After the conclusion of the test, and after answering one more time the QPPF questionnaire, the participants will be asked to fill in a questionnaire (Q2) related to their perceptions and experience during the test, to measure adequacy and quality of the content, aiming to check if the information provided meet their needs. For the version Q2a, some questions regarding the digital tool usage will be included, in order to understand if the tool was well designed and developed, and how important was the interactivity and dynamism provided by digital media. On the other hand, the participants from the Control Group A will answer Q2b which includes questions related to paper-based experience. This will allow a comparison between the two formats, and the main data collection ends after Q2 completion.

For reliability and validity purposes, the participants will be contacted once more for a follow-up questionnaire (QPPF), after they attend the antenatal classes. This collection aims to understand: what are the impacts of being exposed to content, by testing a digital or a paper-based tool; if acknowledging the possibility of listing their birth preferences triggers behavioural changes and the communication with health professionals, namely searching for information in different sources; how obtaining more knowledge helps creating a labour and birth preferences list.

Control Group B will be needed for this part of the study. It will be composed by participants who attended the antenatal classes, but did not participate in the previous part of the study. They will be asked to fill in a questionnaire (Q3) for feedback regarding the classes, plus the QPPF questionnaire for comparison purposes with the other groups.

Figure 2: Data collection plan, by Group.

The literature, namely results from recent systematic reviews (Suto et al, 2016; Brixval, 2016; Kilfoyle, Vitko, O'Conor & Bailey, 2016; Say, Robson & Thomson, 2011; Vlemmix et al, 2013), shows that research on Comprehensive Sexual Education, Childbirth Literacy and Self-care for Health can still be conducted for different contributions, since several topics are unexplored yet. The most common topics found are related to: Satisfaction of women with antenatal education and with the birth outcome; Impact of informed-decision making and decision aids in maternity care; Maternal depression; Maternal and Infant mortality and morbidity rates; Reproductive and sexual behaviours of the women; Impacts on decisions regarding nutrition during pregnancy and for the child; Impact on child development and health outcomes. The less common, but also present, are evidences collected in other studies (Sanders & Crozier, 2018; Wallwiener et al, 2016) regarding: Preventive health care; Influences for pregnant person's decisions regarding birth (Barimani, Frykedal, et al., 2017; Frykedal et al., 2015; Lima-Pereira, Bermudez-Tamayo, & Jasienska, 2012); Paternal depression; Partners' fears and anxiety regarding birth; Partner attendance and satisfaction with childbirth; Satisfaction with the postnatal couple relationship; Parenting behaviours and distress; and Parent-infant interaction.

While the usage of media and e-health technology is a rising topic (Khanum, de Souza, Sayyed & Naz, 2017; Moore, Drey & Ayers, 2017), some literature gaps form the social sciences perspective could be identified: partners participation taking in consideration LGBT+ and different patchwork families (Entsieh & Hallstrom, 2016; Vikstrom & Barimani, 2016); decision tendencies considering different cultural backgrounds, needs, abilities and resources (Frykedal, Rosander, Berlin, & Barimani, 2015); sources of information to their reach (Barimani, Frykedal, et al., 2017).

In what concerns the specific, yet transdiciplinary, field that is Perinatal Digital Education, studies are still scarce. Keeping that in mind, an analysis model was created for this research, and part of it can be seen

on Table 1, related to the *Concept* of *Informed Decision-making regarding birth options*, listing the *Dimensions* and highlighting the *Indicators,* being this part of the major innovations of this research.

Table 1: Part of the Analysis' Model.

Dimensions	Indicators
Knowledge	Access to perinatal formal courses; Searching behaviour for general information, for health, for pregnancy and for labour and birth topics; Access to birth data by format, people and commercial bias; Perception of accuracy when obtained from different sources, channels and formats; Motivation to know more when obtained from different sources, channels and formats; Opinion on the relevance of being informed through scientific evidence.
Values, Attitudes and Behaviours	Tendency on the decisions according to religion, prejudice, fear, life style, believes, empower.
Influence	Influence on the decisions when information comes from different sources, channels and formats.
Pregnant person	Expectations of amount of labour and birth information; Expectations for autonomy on labour and decisions; Opinion on current printed and digital materials distributed by Portuguese National Health System; Sensitivity to explicit content.
Notes: "Different sources" refers to people, institutions and companies; "Different channels" refers to oral, paper and digital; "Different formats" refers to text, visuals and audio.	

3 EXPECTED CONTRIBUTIONS

The innovation of the study resides in filling an existent gap in the literature, since: no studies comparing the outcomes of Print vs. Digital-based Decision aids for Childbirth Education purposes were found; no studies were found on providing information side by side with the decision options for the birth plan creation; the online tools available for birth plan creation are scarce and do not cover a wide range of topics and suffer from limitations of interactivity - details regarding this literature review and benchmarking analysis will be published in the near future; and ultimately, this provides an example how mixed methods can contribute to establish the bridges, not only between two, but three different fields of study.

The research design as planned can contribute to better understand if exposing pregnant women to the created content and to the concept of informed decision-making leverages their knowledge and contributes for the decision-making process for their own birth, and if it triggers rich discussions between them and Childbirth Educators. Besides, the initial data collection is intended to make possible to understand: which are the other agents involved on the Maternal Education; what type of information they provide; how they reach the pregnant person; and the accuracy perceived of that information.

By including a Control Group B, it will also be possible to measure the outcome from antenatal classes of the partner Health Centre, which will be the only source of feedback they have until the moment. Analysing the gathered data may clarify if different learning paths have difference learning outcomes, and if it would be tool to use within the classes. Nevertheless, an online learning and decision aid tool could engage expectant parents who might not available to enroll the classes, due to health, time, transportation and other constrains.

As concluded by Zisman-Ilani, Gordbenko, Shern and Ewlyn (2017) on a study also comparing Digital vs. Paper-base Decision Aids but on a different context (Psychiatric field), it is relevant to develop a specific digital tool so the respondents can address advantages and disadvantages of a particular material. Besides the paper-based materials, an interactive, accessible and digital tool, with simple language and multimedia contents illustrating scientific concept following WHO (2016; 2018) guidelines, it is expected to meet the audience needs, who is not supposed to be expert in health. The proposal is intended to provide safe and reliable source of information, and become a reference for other studies and projects, and which can be used by Childbirth Educators - in Portuguese speaking contexts due to language constrains. Details regarding the creation

and validation of the content created will be published in the near future.

It is relevant to recall that this study is a step forward for Portuguese context and can establish ground for public health policies to recognize women empowerment regarding birth, by providing a proposal which is missing on the Pregnancy Monitoring and Parenting Preparation Program from Directorate-General for Health (DGS, 2015), as a dematerialised option that could be adopted nationally, a topic currently under the political radar (GPPS, 2018).

Due to Coronavirus disease 2019 (COVID-19), the proposed research design may suffer some adjustments in order to comply with the country's most up to date Restrictions Regulations.

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