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A TOOL FOR ANALYSING THE INFORMATION BEHAVIOUR OF EXPECTANT AND NEW MOTHERS

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Abstract:

In recent years, there has been an increase in the variety and availability of information resources in nearly every area of life. Unfortunately, variety and availability don't always signal quality. With health information, it's important not only to have quality information resources but also to ensure resources meet the needs of their audience. Expectant and new mothers have become active consumers of health information. They access and combine information from offline and online resources when making healthcare decisions.

This paper presents a tool that analyses the information behaviour of expectant and new mothers. The Information Behaviour Analysis Tool (IBAT) is based on a theoretical model of information behaviour that is adapted from extant literature. We use interview and activity diary data from the first stage of a longitudinal exploratory study to create and demonstrate the tool. The IBAT can be used to map the information behaviour of new and expectant mothers from beginning to end. Three different search episodes are used to demonstrate the efficacy of the tool and to highlight different types of search strategies. These examples demonstrate the variability of uncertainty as a factor during information behaviour and the interaction it can have when processing different information resources.

Keywords: Information Behaviour, Information Needs, Health, Longitudinal, Data Analysis Tool, Cognitive, Affective, Uncertainty, Expectant Mothers, New Mothers and Pregnancy

1 Introduction

An individual's information behaviour includes 'those activities a person may engage in when identifying his or her own needs for information, searching for such information in any way, and using or transferring that information' (Wilson, 1999, p.249). Information behaviour is complex; individuals can employ different information resources over varying time periods to satisfy their information needs. They can use a combination of different search strategies and they can be influenced by a number of different factors, such as the complexity of the task they are attempting to execute (c.f.Byström and Järvelin, 1995). It is important to map the behaviour patterns of individuals in order to understand why they use particular information resources at certain times to satisfy particular needs. In order to achieve this, this paper reports on the creation of an Information Behaviour Analysis Tool (IBAT). Maps of an individual's current information behaviour can be used to illustrate how they use information resources, what influences resource use and even the impact of those resources. This tool allows researchers to see the different paths that individuals take to fulfil their health information needs. It highlights how factors such as information resources, user preferences and types of needs can interact to influence their information behaviour. A review of the extant literature has not revealed the existence of any similar tools.

This paper uses data from the first stage of an exploratory longitudinal study to develop and test the IBAT. The study follows twelve women for a period of eighteen months, from pregnancy through early motherhood. Three examples from the study are used to demonstrate the tool and to highlight the benefits of mapping health information behaviour. Of particular interest in these examples is the variation of uncertainty throughout the search process. Feelings of uncertainty can lead people to search for information (c.f.Kuhlthau, 1991). However, the information they find can both reduce and increase their feelings of uncertainty (c.f.Case, 2012)

Expectant and new mothers are considered to be active consumers of health information (Bernhardt and Felter, 2004). Studies have shown that they use a variety of different information resources, including social support, online information, and offline printed information in combination with health professionals (cf. Ellins and Coulte, 2005, Lagan et al., 2011). This information is used to make healthcare decisions, such as those that impact their pregnancy. Health information-seeking is considered a characteristic of individuals who are more proactive about their health and has been linked to positive changes in health behaviours (Shi et al., 2004). It has been suggested increased health information-seeking during pregnancy can lead to better self-care abilities, increased knowledge and potentially better pregnancy outcomes (Shieh et al., 2009).

The remainder of the paper is as follows: The next section details the theoretical background behind the research model. The research model is based on Wilson's (1997) model of Information Behaviour. Section Three explains the research approach, discussing the data collection methods and how these led to the development of the IBAT. Section Four uses three examples from the study to demonstrate the benefits of the new IBAT. The final section discusses the implications of the research.

2 Theoretical Background

There are a number of models of information behaviour documented in the literature, such as Dervin's Sense-Making Theory (Dervin and Nilan, 1986), Ellis's Characteristics (Ellis, 1993) and Kuhlthau's Stages (Kuhlthau, 1991). Wilson's (1997) model was proposed as a method of creating a global model which integrated existing research in the field (Wilson, 2000). It was suggested as a 'problem solving' model that had features which could be related both to Kuhlthau's stages and Ellis's characteristics (ibid). More recently investigations have suggested that information-behaviour is more iterative and non-linear in nature (Foster, 2004). For example, research into information seeking by pregnant women (McKenzie, 2003) found that their information behaviour did not always match the systematic search process identified in models such as Wilson's (1997) model.

As such this paper proposes a revised model of information behaviour (Figure 1). This model which is based on Wilson's (1997) model, has two primary objectives: (1) To understand the information

behaviour of expectant and new mothers (2) To attempt to model the non-systematic/non-linear nature of information behaviour within this group. The IBAT, which is described in Section Three, is based on our model and was developed to meet these objectives. The elements of our model are examined below.

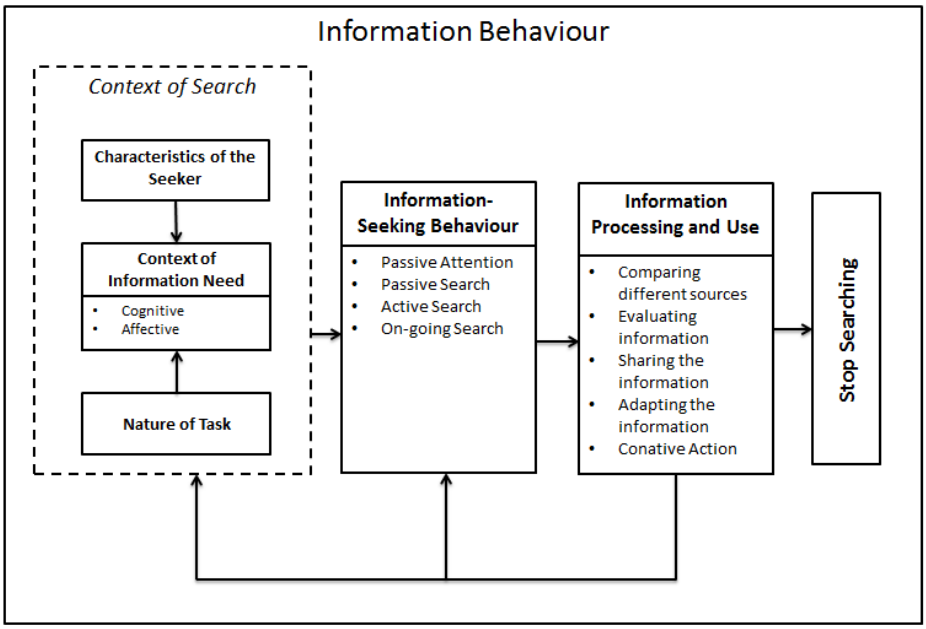


Figure 1. Revised Model of Information Behaviour

2.1 Information Behaviour

The revised model attempts to articulate that information behaviour is often non-linear, with people moving back and forth between the different phases. The first section within information behaviour is the context of search; this includes the factors that can influence all other aspects of the individual's search, from what sources they choose to why they stop searching. This model also includes the concept of action into information processing and use, this is added because it is important to understand how different information-seeking habits influence health behaviours (Anker et al., 2011). A final addition to the model is the concept of stop searching. This is an important addition as it is important to understand how people decide they have enough information and can stop searching and what affects this decision. Research has suggested that people employ different stopping rules depending on the task which prompted the search (Browne and Pitts, 2007). The different elements within information behaviour are examined in greater detail below.

2.1.1 Context of Search

This section considers the factors that can influence an individual's information behaviour. Characteristics of the seeker have been shown to interact with the complexity of the task to influence the selection of different information resources (Hemmer and Heinzl, 2012). Information behaviour is influenced by a number of variables which can interact to influence the outcome of the search activity (cf. Leckie et al., 1996); this research is the first step to attempt to capture those.

- **Characteristics of the Seeker:** Includes elements such as demographics, psychological, role-related factors, and theories which Wilson (1997) would have originally placed under 'Intervening Variables', such as stress and coping. However, it is important to consider other user characteristics and theories when working with your study population, as limiting the model to particular theories could rule out important findings. For example, too much focus on stress and coping in particular may limit studies to situations of threat, particularly in the health information-seeking field (cf. Lambert and Loiselle, 2007). Demographics or role-related factors can influence the information needs or the nature of tasks that are generated. They can also influence the

information resources the user has access to. Examples of other theories that would be relevant include self-efficacy and locus of control. Studies have shown an interplay between self-efficacy and both risk (Rimal, 2006) and negative emotions (Lee et al., 2008).

- **Context of Information Need:** Cognitive and affective information needs are important influencers in both general and health information behaviour models (cf. Kuhlthau, 1991, Johnson and Meischke, 1991). Cognitive needs are considered rational (Lavidge and Steiner, 1961) and focus on information and knowledge (Park et al., 2008), and affective needs involve emotions (Lavidge and Steiner, 1961), moods and feelings (Park et al., 2008). Attitude and preferences are made of both cognition and affect, but preferences are more impacted by affect than cognition (cf. Zajonc and Markus, 1982, Trafimow and Sheeran, 1998). This may explain why emotions, for example anger have been shown to impact the choice of information resources (Griffin et al., 2008) and why affect has also been demonstrated to impact on how users interact with information systems (Deng and Poole, 2010).
- **Nature of Task:** A number of different classification schemes for tasks have been put forward to categorise different types of tasks including Byström and Järvelin (1995) and Kellar (2007). Investigations into the importance of tasks in information behaviour have included a broad range of subjects from professionals (Hughes et al., 2010) to children (Bilal et al., 2008). Task complexity has been shown to increase the complexity of the information needs and to impact on the choice of information channels (Byström and Järvelin, 1995).

2.1.2 Information-Seeking Behaviour

Information-seeking behaviour includes four different strategies (Wilson, 1997): (1) Passive attention, (2) Passive search, (3) Active search, and (4) On-going search. Active information-seeking, where individuals seek out particular information resources to meet their information needs is of obvious interest to health information-seeking investigations. However, in the course of these investigations it has become evident that passive or serendipitous information-seeking, which has somewhat been neglected previously in the literature (cf. Foster and Ford, 2003), can produce the information which resolves an information-seeking episode or can alter the course of one. Some researchers suggest there is a fifth strategy which includes connecting to an information resource through a third party/gatekeeper (McKenzie, 2003).

2.1.3 Information Processing and Use

There has been a dearth of research into information use (Niemelä et al., 2012, Tuominen and Savolainen, 1997). This has led to a lack of conceptual clarity (Niemelä et al., 2012, Bawden and Robinson, 2012, Savolainen, 2009). This lack of investigation includes researchers who have used or adapted Wilson's (1997) model, as many have not chosen to examine the concept in the course of their work (e.g. Shieh et al., 2009, Ford et al., 2005, Heinström, 2003). For the purpose of this study, the concept will be defined as comparing and evaluating different information. Also included is the idea of adapting and sharing information, as this can be an important element of social resources. Finally, we have included the concept of conative action. Conative action is the development of motivation and intention to commit an action (Lavidge and Steiner, 1961). It develops from either cognition or affect or a combination of the two (Park et al., 2008).

3 Research Approach

This exploratory research employs a qualitative longitudinal approach. Longitudinal studies are effective at studying the interaction between variables and how their relationships change over time (Jurison, 1996). However, they are relatively rare in mainstream IS (information systems) and particularly in Information Behaviour studies (cf. Anker et al., 2011, Jurison, 1996). The central focus of this study is the evolution of the information behaviour of expectant and new mothers over time. By observing the same women over a period of eighteen months, we attempt to build a rich picture of what factors influence the choice of different information resources and how these decisions influences health behaviours.

3.1 Data Collection

The case study approach was chosen because it is particularly suited for situations where it is difficult to remove the context from the subject being investigated (Yin, 2003) and the context of information need is a vital part of information behaviour. The study was advertised in multiple locations including the university, a pregnancy yoga class and a number of pregnancy forums and Facebook groups. To be in the study, women had to be over three months pregnant and willing to commit to an eighteen month study. No compensation was given to the women who agreed participate in the study.

Throughout the eighteen month study data is collected from each woman using both semi-structured interviews and an activity journal at three-month intervals. Semi-structured interviews allow detailed evidence to be obtained from participants, while encouraging them to suggest areas or problems which they think are important to the area being investigated (Remenyi and Williams, 1995). An activity journal is maintained by each woman and discussed during the interview. They detail their information-seeking stories, and include ratings of the information sources that they have used. A blank diary is available online[1].

While the theoretical model and the activity journal form the basis for the interview guide, participants are encouraged to elaborate and explore areas that they consider relevant. Qualitative longitudinal studies allow for the evolution of both the theoretical model and the data collection instruments (i.e. interview guide) throughout the research process because of findings that may emerge from the field or due to developments in literature (c.f.Eisenhardt, 1989).

Interview recordings and data from the activity journals are coded after each interview using an initial set of codes based on the research model, with additional codes allowed to emerge from the data (Miles and Huberman, 1994). While qualitative forms of analysis are more labour intensive than more strict quantitative based schemes, they do offer a greater degree of explanatory power when a researcher is investigating the meaning behind a user's actions (DeSanctis and Poole, 1994). At the end of each stage of interviews, older recordings are reanalysed based on any new emergent codes to see if changes are required (c.f.Miles and Huberman, 1994).

3.2 IBAT: Information Behaviour Analysis Tool

The IBAT was developed based on the theoretical model presented at the beginning of this paper and refined using data collected during the first stages of the study, see Figure 2. This tool is useful for both data collection and analysis. During the data collection phase the interviewer can use it to sketch a diagram during the interview. It can help to draw out the interviewee and to ensure the interviewer is getting an accurate picture of the information behaviour process. During data analysis it can be used to build more accurate information behaviour maps using transcripts. The information behaviour maps can then be used to compare against each other to look for patterns or anomalies.

Uncertainty	Context of Search	Information-Seeking Behaviour	Information Processing and Use

Figure 2. Information Behaviour Analysis Tool (IBAT)

The arrangement of the tool differs from the model to allow the researcher to analyse the participants' information-seeking stories more effectively. A column was added to the left of the tool, currently labelled uncertainty. This column can be used to focus on how any important factor changes throughout the search process. Uncertainty was monitored in these examples because it is an important concept in information behaviour research (Kamal and Burkell, 2011). Uncertainty is linked to a gap in knowledge and is often considered the impetus behind information-seeking (cf. Belkin et al., 1982, Kuhlthau, 1991). Evidence suggests that there is a close link between peoples judgement of the relevance of information and their feelings of uncertainty (Attfield and Dowell, 2003). Research has also found that uncertainty cannot always be completely mitigated by information resources

[1] https://www.dropbox.com/s/lpnjw76r1byipl3/ActivityJournal.doc

(Kamal and Burkell, 2011). Examples of other factors that could be monitored using this column, other than uncertainty, include level of anxiety, degree of task completion or general health state.

The next section uses three samples from the first round of data collection to illustrate the effectiveness of the IBAT. As this data comes from the first stage of the study, the examples are all of expectant mothers. The IBAT allows for easy comparison across multiple search episodes of either one or multiple individuals. This makes it useful in both cross sectional and longitudinal forms of analysis.

4 Findings and Data Analysis

This section demonstrates the IBAT using three different search episodes from three different women. Space restrictions limited the number of examples that could be chosen, but these three examples are sufficiently different as to allow for an evaluation of the tools capabilities. The three women have different information needs and use different search strategies to satisfy them. The first episode details a search for information relating to back pain in pregnancy. The second is sudden onset vomiting and the third involves the general need for information in early pregnancy. Other than their differences, these three search episodes were selected because all three lead to an action or a set of actions.

4.1 Search Episode One: Multiple Information Resources, Information Need Satisfied

The first example (figure 3) involves a woman in her second trimester. She is married with a fifteen month old son. She has searched for more information on her second pregnancy for several reasons: (1) She felt that she is more aware of what can go wrong having gone through labour before, (2) She experienced complications with this pregnancy which did not occur with her first pregnancy, (3) Her GP (general practitioner) advised her against seeking additional information on her first pregnancy. Although her GP is still of the opinion that it is better for people to not search for information outside of what their health professionals give them, she felt she needed the additional information for peace of mind. She uses a variety of different information resources including the internet, books, health professionals, friends and family. Her preference is for information to be confirmed by more than one source, triangulation.

The search episode began with back pain and a desire to find solutions which are safe during pregnancy. This need has two parts; the first is the desire for information (cognitive) the second is the need for reassurance that there are other women who have experienced similar symptoms, that this is normal (affective). The initial search strategy adopted was active search, and the source was internet forums. The internet forums helped to satisfy both the cognitive and affective elements of the information need. However, a solution was not found from the initial search strategy. The next search strategy was the first of two encounters with passive attention, when information is gained without actively looking for it (such as everyday conversation or watching TV) (c.f.Wilson, 1997). While talking to a male colleague, the subject of her back pain came up. He suggested a heat pack as a solution. This had the impact of increasing her level of uncertainty because he did not meet her criteria for a preferred source of information. He was not a medical professional and obviously he was not now, nor had he recently been, pregnant. The information also had the effect of increasing her feelings of uncertainty and altering her information need, as she then needed to investigate if his solution was a safe option for pregnancy.

The third search strategy, returned to active search and internet forums. The internet forums increased the doubt that she was feeling about the safety of the heat patch during pregnancy. This doubt was further increased, by a fourth search strategy that was a return to passive search. A phone call from her mother resulted in a conversation about the current problem and the heat patch. Combining the results from these different sources resulted in the participant rejecting the heat patch as an option.

The final source of information was another work colleague, but this colleague was female and had recently had a baby. The colleague recounted her personal experience of acupuncture helping relieve back pain during pregnancy. This information had the effect of fulfilling the cognitive need for

information, and as the source met her list of preferences for information of this type it also helped meet her affective needs. The combination of cognitive and affective satisfaction helped to motivate her to book an appointment for acupuncture (conative action).

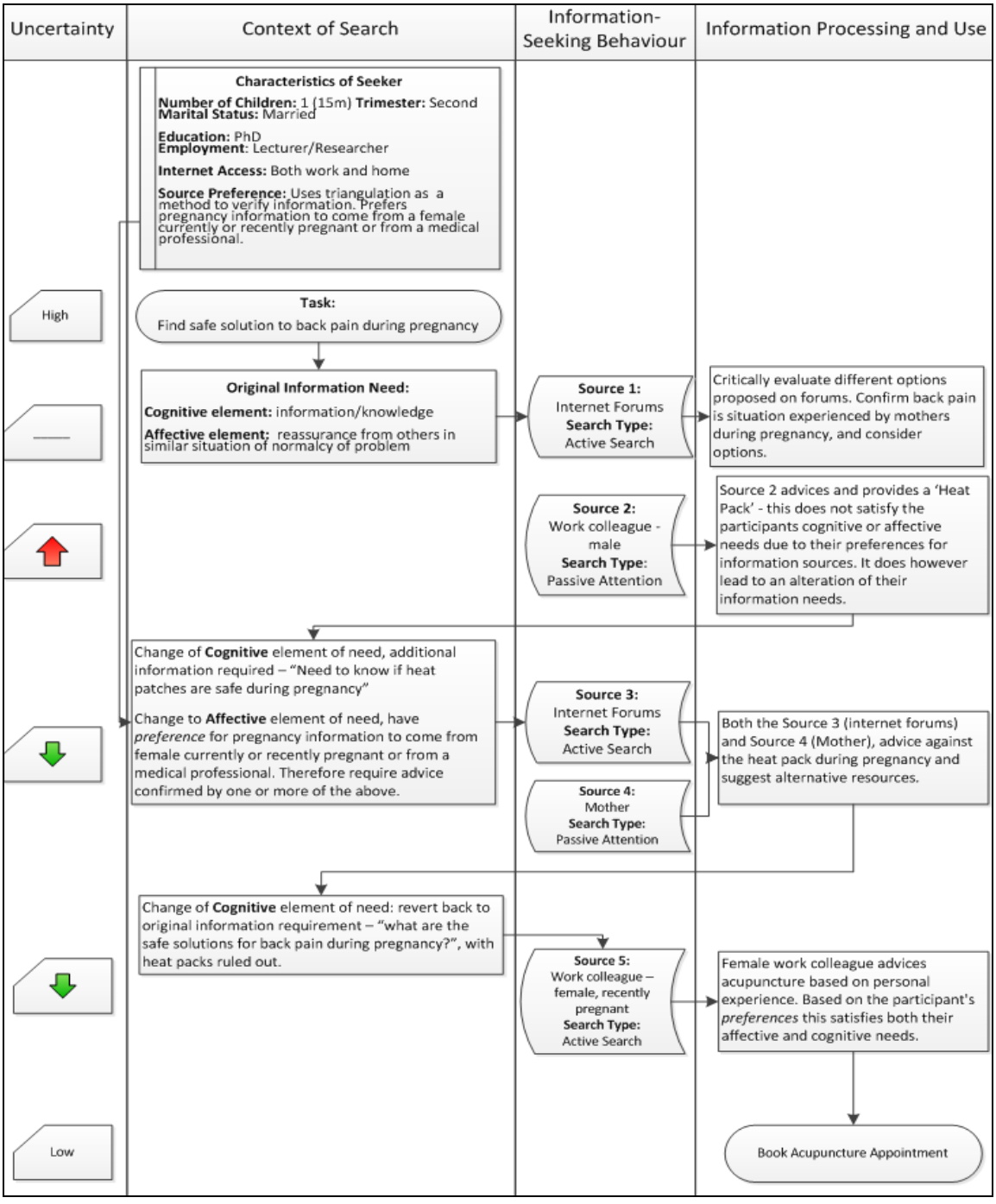


Figure 3. IBAT – Example 1

4.2 Search Episode Two: One Credible Information Resource, Information Need Satisfied

The second example (Figure 4) involves a woman in her third trimester. She is pregnant on her second child. She has experienced morning sickness, a chest infection and the winter vomiting bug ('norovirus'), none of which were an issue during her first pregnancy. As her child is sixteen months old she feels that advice would not have altered significantly since her first pregnancy. Both her illness and the impression that medical advice would not have had a chance to progress since her first

pregnancy has led to a reduced interest in seeking information. When she searches for information, she believes in having one credible source of information to go by. She has only one pregnancy book. When she searches online, she uses keywords to direct her search and picks sites from organisations she trusts. She does not value internet forums for health advice, but she does use internet forums in her social life.

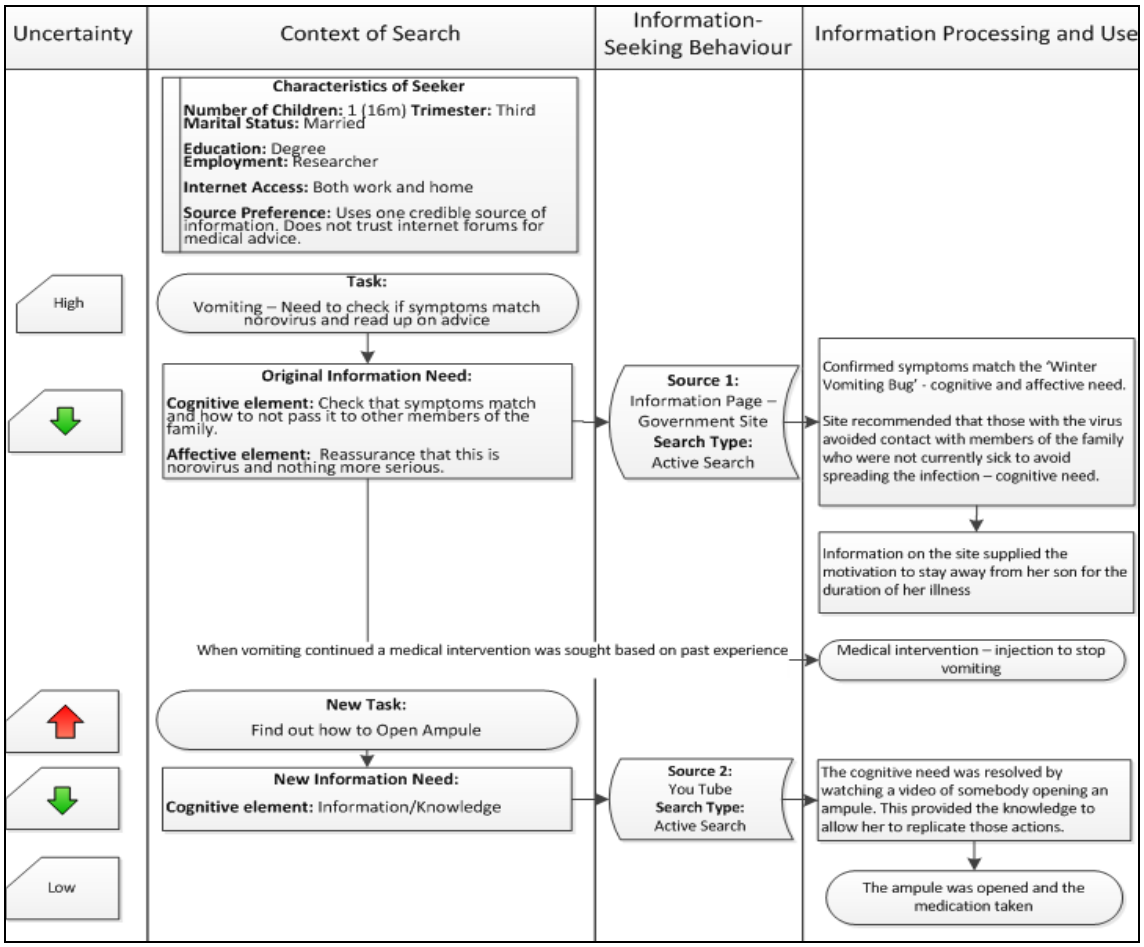


Figure 4. IBAT – Example 2

The search episode began because she was experiencing vomiting in the middle of the night. When the vomiting episode continued and because her son had previously had the winter vomiting bug, she decided to search the CDC website for information on the norovirus. She accessed the CDC website using a targeted search through a search engine – including the keywords 'CDC' and 'norovirus'. She selected it because she perceived it to be an official website, with up-to-date, relevant information. The information from the website satisfied her cognitive need for information and her affective need for reassurance that the symptoms matched the winter vomiting bug and nothing more serious. She followed the recommendations from the site to avoid contact with her son, who no longer had the virus, until after she was over the infection. By confirming that she had the norovirus and supplying guidelines for how long she should avoid contact with her son, the site also reduced her feelings of uncertainty.

When the vomiting continued to persist she decided to go the doctor to get an injection to stop her vomiting, this decision was based partly on past experience with the norovirus. While at the doctor, she did not pay attention to how the doctor opened the ampule, which contained the anti-sickness medication. This led to the development of a new task and new cognitive information need when she got home; it also led to a temporary increase in uncertainty due to the new cognitive gap. To solve this need, she searched for a video on You Tube to see how to open the ampule. Once this cognitive need was solved, so was the feeling of uncertainty and she was able to complete the action and take her medication.

4.3 Search Episode Three: Multiple Information Resources, Information Need Partly Satisfied

The final example (Figure 5) involves a first time mother who has found it difficult navigating the conflicting information she has found across the different information resources available. Not only has she identified conflicts between recommendations on eHealth websites, but she has also experienced differences in the advice given by different health professionals. When she finds it too challenging to resolve the conflicts herself she consults her sisters who both have children of their own. She uses a combination of the internet, mobile applications, books, health professionals, along with friends and family. The internet is one of her biggest sources of information. She is a member of a number of Facebook groups and pregnancy forums. However, she only contributes to the forums, because they provide the benefit of anonymity, which Facebook does not. Although she read books a lot early on in her pregnancy, her use of books has been declining and replaced by mobile applications due to their convenience.

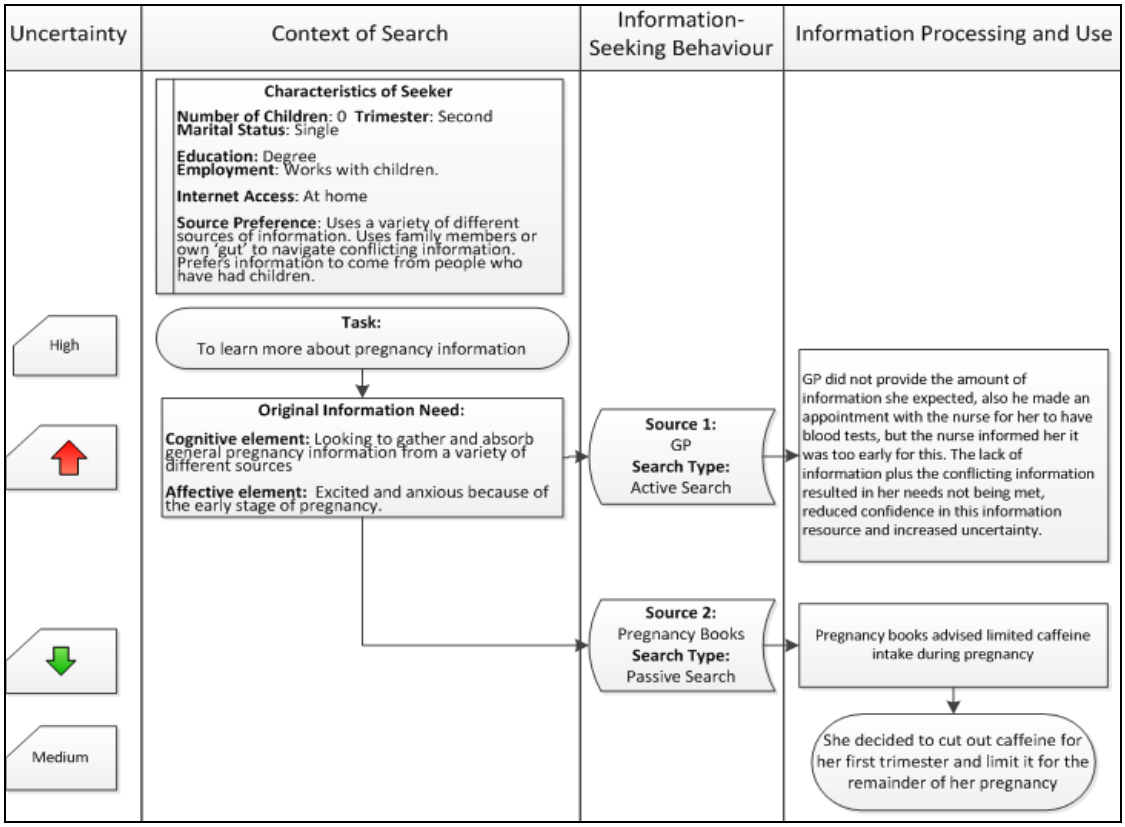


Figure 5. IBAT – Example 3

The search episode is from her first trimester. It is a snapshot of a longer search process/episode, this is because searches with general goals can span longer time frames and contain a number of micro searches. At the early stages of her pregnancy, she attempted to satisfy her cognitive need for general pregnancy information and her affective feelings of excitement and doubt by reading different pregnancy books and attending her GP. She was disappointed with the information provided by her GP because he did not provide enough information and there were conflicts between him and the nurse. Due to this her feelings of uncertainty were increased and she sought out other sources of information. The second source, the pregnancy books, has been coded as passive searching. Passive searching is a type of semi-directed browsing, which happens to lead to the acquisition of useful information (c.f. Wilson, 1997). While browsing the pregnancy books, she uncovered advice to limit caffeine consumption during pregnancy. This motivated her to cut out caffeine during her first trimester and to reduce her consumption for the remainder of her pregnancy. The level of uncertainty was not completely reduced because she did not have confidence that her GP would provide her with all the information she might require in the future.

5 Discussion and Implications

This paper has discussed the results of the first stage of a longitudinal study and how it has led to the creation of an Information Behaviour Analysis Tool (IBAT). By using three examples, this paper has attempted to illustrate how the tool can be used to gain a better understanding of the information behaviour of expectant and new mothers. Information behaviour can follow both a linear and non-linear path (Dervin, 2005) depending on the individual, the particular need and the other contextual factors (such as uncertainty). Using the IBAT tool to map the search behaviour in our examples has emphasised that information behaviour for expectant and new mothers is often iterative in nature as depicted in the research model at the start of this paper. Two of the search episodes, one and three, are obvious examples of iterative information behaviour, moving back and forth between the different stages. Search episode two could be an example of iterative searching, or it could be argued that it is two separate, but related, linear search episodes.

The three examples in this paper have illustrated how uncertainty can go up as well as down during the search process, highlighting that information resources can both reduce and increase feelings of uncertainty. Search episodes one and three both experienced an increase in their feelings of uncertainty after using information resources, but this increase was caused for different reasons. In episode one, the information resource was not a trusted source of pregnancy advice, so information received from this source was immediately valued less than if it had come from a more highly valued resource. This is an example of how the characteristics of the resource, or perceptions of those characteristics, can affect feelings of uncertainty and how information is processed. These findings complement previous studies that have found that the characteristics of information resources, such as how the information is presented and if the resource is trusted, influences how the information is processed (c.f.Sillence et al., 2007, Thom et al., 2002). In episode three, the information resource was a trusted source but the information provided was insufficient and part of it, the direction to get her bloods taken, conflicted with another trusted source. This is an example of how the characteristics of the information can influence feelings of uncertainty.

By comparing the three search episodes analysed in this paper we can begin to see the impact of contextual factors such as source preference, task, and information need on how information resources are chosen and processed by expectant and new mothers, although the small number of examples obviously limits any generalizability. This paper has highlighted the variability of uncertainty during the different stages of information behaviour. Research has shown a link between how people process information and feelings of uncertainty. Here we have found that both the characteristics of information resources and the information they contain can influence the level of uncertainty experienced. The use of the tool allows for easier comparison of different types of search episodes, and can result in the identification of patterns which may be missed otherwise. By grouping multiple search episodes together, it will be possible to gain greater understanding of how these important factors interact within information behaviour. In the future, this tool could be used in alternative information-seeking domains to explore what factors are common across all domains for influencing information resource processing and use and what other factors mediate their impact.

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