AUTHOR(S):

TITLE:

YEAR:

Publisher citation:

OpenAIR citation:

Information seeking behavioural paths of physicians for diabetes mellitus care: A qualitative comparative analysis of information needs, sources and barriers.

Petros A. Kostagiolas

(pkostagiolas@ionio.gr)

Department of Archive and Library Science, Ionian University, Corfu, Greece;

Panos E. Kourouthanassis

(pkour@ionio.gr)

Department of Informatics, Ionian University, Corfu, Greece

Konstantina Martzoukou

(k.martzoukou@rgu.ac.uk)

Department of Information Management, The Robert Gordon University, Aberdeen, Scotland

Nikolaos Korfiatis

(n.korfiatis@uea.ac.uk)

Norwich Business School, University of East Anglia, Norwich, United Kingdom

Dimitrios Niakas

(dniakas@eap.gr)

Faculty of Social Sciences, Health Care Management, Hellenic Open University, Patras, Greece

Information seeking behavioural paths of physicians for diabetes mellitus care: A qualitative comparative analysis of information needs, sources and barriers

Abstract

This study addresses diabetes physicians' information seeking behavioural paths (digital, conventional, interpersonal) which lead to information needs satisfaction and the barriers encountered in this process. The study was based on empirical evidence from a survey of 159 physicians. Theoretical analysis was informed by Wilson's model of information-seeking behaviour. The data were analyzed using fuzzy set qualitative comparative analysis (fsQCA) method. The method was successful in identifying five behavioural paths leading to physicians' information needs satisfaction (professional/health coaching) which demonstrate different relationships between information sources (conventional/interpersonal/digital) and information barriers (personal/digital illiteracy) and five behavioural paths that are not leading to satisfaction.

1. Introduction

Information and exchange of knowledge have an important role to play in the management of diabetes and the clinical evidence-based decision making process. Successful diabetes care relies on the efficient utilization of specialized information services and systems. Physicians need information literacy skills in order to keep up to date and develop expertise in chronic diabetes patient-centered care. For the management of diabetes mellitus (DM), physicians rely on a range of different information sources. For example, web-based information seeking is crucial and integral to clinical practice and is taking place by medical doctors in order to address a range of information needs regarding diagnosis, drug questions, and patient education (Anker et al., 2011; Bennett et al., 2004; Davies & Harrison, 2007; Younger, 2010). In order to satisfy daily clinical information needs and make decisions, physicians also communicate with other medical professionals to exchange information or they consult print reference/ journal material. The latter influence decisions in regard to primary care choices made about a particular patient (Gikas et al., 2006) or the timely appointment of a DM patient to a secondary healthcare unit for hospitalization (Brez et al., 2009).

Previous research has explored the complexity of information needs that physicians experience in the context of their work (related to their professional role), the range of information sources they use for satisfying these needs (Anker et al., 2011; Davies, 2011a; Younger, 2010) and the barriers they encounter in the process (such as lack of time, IT issues and limited search skills). Interestingly, existing research reveals that medical doctors prefer to keep themselves informed primarily through offline (e.g. interpersonal relationships, medical conferences, print health material) than online information sources (e.g. medical websites, search engines, and online scientific journals) (Clarke et al., 2013; Olatokun & Ajagbe, 2010). However, recent studies report an uprise in the usage of online information sources (Clarke et al., 2013; Hughes et al., 2009) in conjunction with their offline counterparts, suggesting that there is a synergy between the selection of particular information sources with specific information needs factoring for the inherent obstacles hindered by the information search process. This synergetic nature between needs, sources, and information barriers indicates that rarely do physicians rely on a single, 'optimal', mix to satisfy their information needs; on the opposite, different information sources may equally satisfy physicians' information needs depending on the context (i.e., specific information need) and any preventive factors (i.e., information barriers) that influence the search process.

Moreover, extant studies on the subject follow a static investigation lens through the identification of prevalent information needs, sources, and barriers in different work/ task contexts (Clarke et al., 2013; Davies, 2011b; Olatokun & Ajagbe, 2010; Younger, 2010). The dynamic interrelations of these dimensions and their combined effect on the overall satisfaction of physicians' information needs remains largely unexplored. Based on the above, this research addresses the following research question: *What configurations of information needs, information sources, and information barriers lead to satisfied physicians?* For health management, in particular, the degree of information satisfaction plays a critical role in clinical decision making of physicians, since bridging the satisfaction gap between the information needs and the available information sources yields to uncertainty reduction pertaining the accumulated information, and, ultimately, improved clinical medical practice (Figueiras et al., 2000; Tierney, 2001; Wanzer et al., 2004).

Our research builds on configuration theory and implements a fuzzy-set qualitative comparative analysis (fsQCA) (Rihoux & Ragin, 2009), to identify the pertinent configurations

leading to different degrees of information satisfaction for physicians. fsQCA has received increased attention during the last years in various fields, because it allows researchers to gain a deeper understanding of the research phenomena under scrutiny (Ordanini et al., 2013; Woodside, 2013). The method has been extensively used to tackle case-oriented research phenomena, nevertheless scholars have recently showcased its application and value on social and behavioural science problems (Liu et al., 2015; Pappas et al., 2016). Although the context of our study is DM, we posit that the proposed model may be employed in explaining the information seeking behaviour of health professionals in general.

2. Background and theoretical grounding

Perspectives on information seeking and information satisfaction

Individuals have always been engaged in information seeking, which has evolved from an instinct to an important human socio-cognitive ability and competency (Spink & Cole, 2007). The involvedness of studying the relevant concepts lay in the dense concept of 'information', the troublesome concept of 'information needs' as well as the wide range of distinct interdisciplinary facets of information seeking research (Bawden, 2006). A broad conceptualization of information seeking studies is related to decision making and the concept of satisfying human needs in relation to specific objectives or goal states (Case, 2012). This conceptualization unavoidably relates information, and thereafter higher-order concepts, such as 'information needs', 'information seeking' and 'information needs satisfaction', with uncertainty reduction theories for human needs satisfaction (Wilson, 1997).

Reducing uncertainty is a concrete motivator for information seeking. As a consequence, individuals seek information in response to differences in their current levels of information against their objectives or goal states they want to reach (Li & Belkin, 2010). Since information seeking follows an evolutionary path (i.e., from needs generation, to selection of information sources, and ultimately, to information needs satisfaction), scholars have formalized the different stages of the information search process through both cognitive and affective lenses (Kuhlthau et al., 2008; Savolainen, 2015). Extant information seeking models acknowledge the pivotal role of information needs as motivational element. In effect, Case (2012) relate information seeking with motivation-based theories, such as uses and gratifications theory and sense-making theory. On the one hand, intrinsic and extrinsic motivations will drive individuals to search for information and dictate their information selection choices (Bouwman & Van De Wijngaert, 2002; Tustin, 2010). On the other hand, information seeking is a purposeful activity and individuals will interpret and make sense of any retrieved material under the context of bridging their information gaps (Dervin et al., 2003; Savolainen, 2006).

Nevertheless, information needs are usually ambiguous (Wilson, 2006); their substantiation and clarity for individuals will transpire when they are linked to personal, environmental, or work contexts (Savolainen, 2012). This is a task-based perspective of information needs development and thereafter information seeking behaviour. Indeed, the information seeking process endorses the notion of bounded rationality. Optimally, information seekers could consider and utilize all alternative sources of information until they would fully satisfy their information needs. However, such an exhaustive analysis may not be pursued in practice due to the increased time and effort required for the possibility of finding information of added value that outweighs the additional search costs (Spink et al., 2007). Effort-based theories, such as the least effort theory and information overload theory, further substantiate this argument suggesting that information seekers will accept information of lower quality or quantity in order

to minimize their efforts to search for information or tackle the anxieties imposed by the abundance of available information (Bawden & Robinson, 2009; Hertzum & Pejtersen, 2000). Therefore, individuals might prefer to consider that their information needs are satisfied when they find information which is good enough for their needs (Adams et al., 2007). This behavior is coined with the term 'satisficing' and describes the situation where individuals settle with a solution to a problem that is sufficient (Simon (1957) as cited in Kunda (1999)).

In the context of health, physicians tend to seek for specific type of health-related information (e.g. related to diagnosis, treatment, medication, epidemiological profile, patient education, research and training etc.) (Clarke et al., 2013; Coumou & Meijman, 2006; Davies, 2011b; Davies & Harrison, 2007). To do so, physicians utilize a number of information resources for satisfying their diverse information needs (Clarke et al., 2013; Younger, 2010). In their daily routines, physicians employ online information resources (Del Fiol & Haug, 2008; Metzger & Flanagin, 2011), together with offline information resources, such as hospital libraries and textbooks (Masters, 2008). The combinations of resources employed are related to specific information needs, as well as to the obstacles associated to the efficient utilization of certain information resources (e.g. lack of time, cost, and unfamiliarity with information resources) (Adams et al., 2007). At the same time, for certain information needs, most physicians opt to use the information resources they know and trust (Ely et al., 2005; Hughes et al., 2009).

Physicians' socioeconomic environment and work conditions define a bounded rationality within which they seek information to make medical judgments or choices that are sufficient for their purposes, but could be optimized (Ely et al., 2005). However, this medical decision making optimization should be justified by the extra costs carried in additional information seeking. The costs are related to barriers when seeking information, which can be personal or environmental, such as domain expertise of the user, skills in searching for information, and access to certain information resources (Davies, 2011a; Eden et al., 2016; Ely et al., 2005; González-González et al., 2007). Ultimately, information satisfaction is related to the physician feelings for the accomplishment of the desired level of edification for making a satisficing clinical decision (Davies, 2011b; Davies & Harrison, 2007). Physicians' information needs satisfaction is related to a multitude of benefits, which include uncertainty reduction pertaining medical judgments and patient-physician communication (Wanzer et al., 2004), as well as improved medical practice in terms of better prescription (Figueiras et al., 2000) and overall clinical decisions (Tierney, 2001).

Framing the information seeking behaviour of physicians

The information in context perspective includes understanding of the information seeking preferences and information needs of individuals, which relate to the satisfaction of cognitive, affinitive, or psychological individuals' needs (Case, 2012). Under this auspice, Wilson (2006) suggests a nested synopsis of the relevant literature, with 'information behaviour' as the broader field of research, within which 'information seeking behaviour' and 'information search behaviour' are nested, respectively. A holistic study of information seeking behaviour recognizes the multidimensional nature of information seeking and attempts to uncover the dynamic phenomena that take place during that process (Martzoukou, 2005). Determining factors for information needs and information-seeking behaviour includes the socioeconomic climate, the political systems, the physical environment and others. From the extensive range of human needs that may drive individuals to seek information, Wilson identified those arise

from work roles as being most likely to be relevant to the specialized or formal information systems (Bawden, 2006).

The aforementioned suggestion made by Bawden (2006) for the appropriateness of Wilson's scheme to model individuals' behaviour towards uncertainty reduction within information intensive role-based situations put this particular model at the epicentre of our analysis. Therefore, among the plethora of information seeking models the Wilson's (2002) macro-model for information seeking deemed to be appropriate since it focuses on the performance of particular tasks, and the processes of planning and decision-making as information seeking generators. Wilson interprets information seeking behaviour as a goal directed activity aimed at the reduction of uncertainty within a specific decision making situation. Within Wilson's context, individuals play a range of intertwined roles and may encounter a variety of different barriers, which can be of personal, interpersonal or environmental nature (Kostagiolas et al., 2013). The latter constitute possible hindrances to information seeking that obstruct the progress towards addressing primary needs. Wilson (1997) coins them with the term 'intervening variables' on the premise of examining both obstacles and enablers in relation to information seeking. The intervening concepts can be psychological, demographic, role-related, interpersonal, and environmental of the characteristics of the information resource used. An intervening variable may be both a facilitator and barrier for the information search process depending on the perceptions of the individual. For example, digital literacy has been coined as an important facilitator of information seeking on the Internet for health professionals (Jiang & Beaudoin, 2016; Younger, 2010). Nevertheless, digital illiterate individuals will perceive it as a barrier and will be directed towards offline information resources to satisfy their information needs. Wilson's model has been extensively employed to capture the information seeking behaviour or medical professionals or patients (e.g. Pluye et al. (2013), Kostagiolas, et. al. (2013), Greyson et al. (2012), and Beverley et al. (2007) to name a few applications of the model in healthcare settings).

Figure 1 portrays the foundation of this study based on Wilson's model within a medical decision making process. The model recognizes the interrelationships between individuals (users of information formulating specific information needs under specific usage contexts and tasks), information sources (formal or informal information systems), and response outcome of the information seeking process (satisfaction of information needs). Within this premise:

- Information seeking behaviour is initiating from the physicians' recognition of specific information needs that arise when medical decisions are required, for example when informing a patient about different treatment options (Hou & Shim, 2010).
- The physician interacts with the information universe by utilizing different information resources including other persons (information exchange) or various online and offline information systems (Hughes et al., 2009). Within this information space the different information resources are either 'competing' in a sense that some information resources are 'supplementing' or 'substituting' other resources or 'amalgamating' through system/ services integration.
- Within this process, physicians' may encounter a variety of different barriers/ facilitators (Eden et al., 2016; Kostagiolas et al., 2013) that intervene between information needs generation and information needs satisfaction and can be personal or situational in nature. The utilization of information resources could lead to satisfaction of physicians' information needs and, thus, generate informed decisions for a particular medical situation.
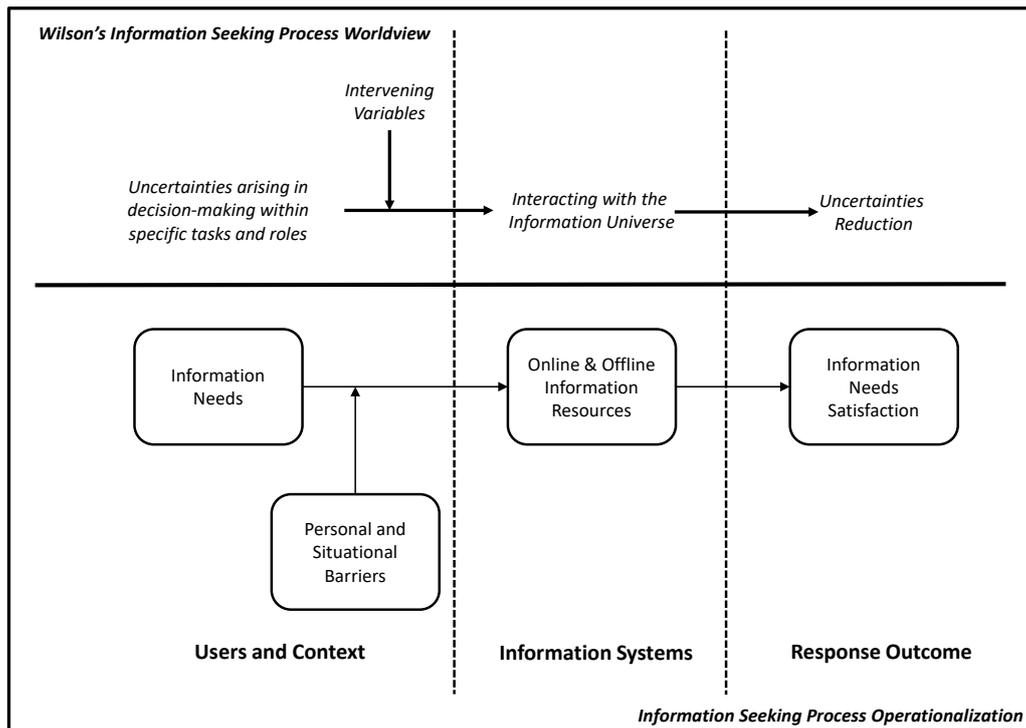
Figure 1 Theoretical articulation of the information seeking process and operationalization on healthcare settings

Research aims and objectives

Having identified the individual stages of information seeking, we now turn our attention to exploring the paths that lead to information satisfaction through combinations of groups of information needs, utilization of specific information resources and interventions of specific information obstacles. For this purpose we incorporated configuration theory. The theory involves the principle of *equifinality* and proposes the manifestation of *causal asymmetry* (Fiss, 2011; Woodside, 2013). Equifinality suggests that the outcome of interest may be explained similarly by alternative sets of causal conditions, which combine in sufficient configurations for the outcome. For example, physicians' information satisfaction may equally be attained through multiple combinations of healthcare information resources utilization in the presence of different information obstacles (Hesse et al., 2005). Indeed, physicians of analogous information literacy profiles may satisfy their information needs either by conducting colleagues (information exchange), or by utilizing conventional resources, such as a medical library or through employment of online scholarly information resources. Moreover, other factors, such as trust predisposition towards to information source may influence the selection of sources and, ultimately, the degree of accumulated information satisfaction (Johnson et al., 2015; Kostagiolas et al., 2014).

Moreover, configuration theory proposes the manifestation of causal asymmetry (Fiss, 2011; Woodside, 2013). Causal asymmetry implies that different values of the same causal condition may appear in the combinations that explain overall information satisfaction depending on these conditions combine with each other. For example, high information satisfaction may be achieved through utilization of both offline and online information sources depending on the medical information needs covered, the information barriers met and personal characteristics of physicians. In effect, previous research on medical information seeking indicates an

[7]

association between physicians' information satisfaction and the employment of specific information resources (Anker et al., 2011). Some authors indicate that physicians rely significantly on informal sources of information and that they prefer human information sources more than traditional print or electronic sources (Younger, 2010). However, what is also clear is that physicians may demonstrate different source preferences for different information needs. Bennett et al. (Bennett et al., 2006) report that physicians prefer to consult their colleagues when they were unsure about diagnostic and management issues and when a medical case was complex. Similarly, research conducted by Coumou & Meijman (2006) concluded that despite physicians' wide access to electronic clinical information on the Internet, information was still primarily sourced via communication with other physicians. However, this activity of information consultation rather than formal information seeking (which has been defined as "curbside consultation") was found to be aimed at information needs which focused on confirming existing knowledge and finding quick answers to clinical questions. On the other hand, when it comes to professional development information needs the physicians' seem to prefer online information resources (MacWalter et al., 2016).

Along this line, information barriers (or enablers), such as the physicians' information literacy skills (Jiang & Beaudoin, 2016) are particularly important within the context of healthcare and health decision-making (Yeager et al., 2014), especially in view of previous research findings which indicate physicians' overreliance on informal information sources (Clarke et al., 2013). To effectively practice evidence-based healthcare, physicians must develop information literacy skills that will help them exploit a variety of different information sources (both formal and informal) but also make appropriate choices in relation to the significance and urgency of their information needs (Jiang & Beaudoin, 2016; Younger, 2010). In other words, they should be able to recognise what kind and how much information is required for their specific information needs in view of any associated barriers, created by time, the format and currency of that information as well as issues of access. In addition, they should be able to identify what resources are available for exploitation (both formal and informal), how to access them and when it is appropriate to use them as well as be in a position to search effectively across different information sources. To effectively practice evidence-based medicine and become lifelong learners, physicians must make intelligent information choices in their patient-centred and clinical research context. Without these skills, they will be unable to develop their core roles as medical experts (Rudin et al., 2014). Finally, personal factors, such as age and the work context influences the selection of information sources by health professionals, and, ultimately, the degree of satisfaction for their information needs (Anker et al., 2011; Kostagiolas et al., 2014).

Based on the aforementioned argumentation, the study puts forth the following research propositions:

Proposition 1: There is not an optimal configuration of information needs, information sources, and information barriers that leads to highly satisfied information needs for DM physicians, but there exist multiple, equally effective, configurations that include combinations of causal factors.

This proposition suggests that information needs satisfaction for DM physicians may not be universally achieved through a single combination of information seeking behaviour constituents. Instead, information sources selection, and the accumulated perceptions of information needs satisfaction, will be related to specific information needs and inherent information barriers.

Proposition 2: *Single causal conditions (i.e., information needs, information sources, and information barriers) may be required to be present or absent within configurations that explain high perceptions of information needs satisfaction for DM physicians depending on how they combine with each other.*

The second proposition practically suggests that DM physicians do not commonly follow the same perceptions pattern within the configurations space that explain information needs satisfaction. Instead, these perceptions may vary depending on the interactions among the causal conditions. For instance, physicians that primarily use online resources and physicians that never use the Internet may equally satisfy the same information needs. The difference in their selection preference might be attributed to the existence (or absence) of inherent information barriers.

Figure 2 reflects the conceptual framework of the study by employing a Venn diagram to illustrate the possible interventions between the examined information seeking behaviour components to explain information needs satisfaction. It should be noted that both propositions are expected to also hold true for negated outcomes, namely not (highly) satisfied information needs.
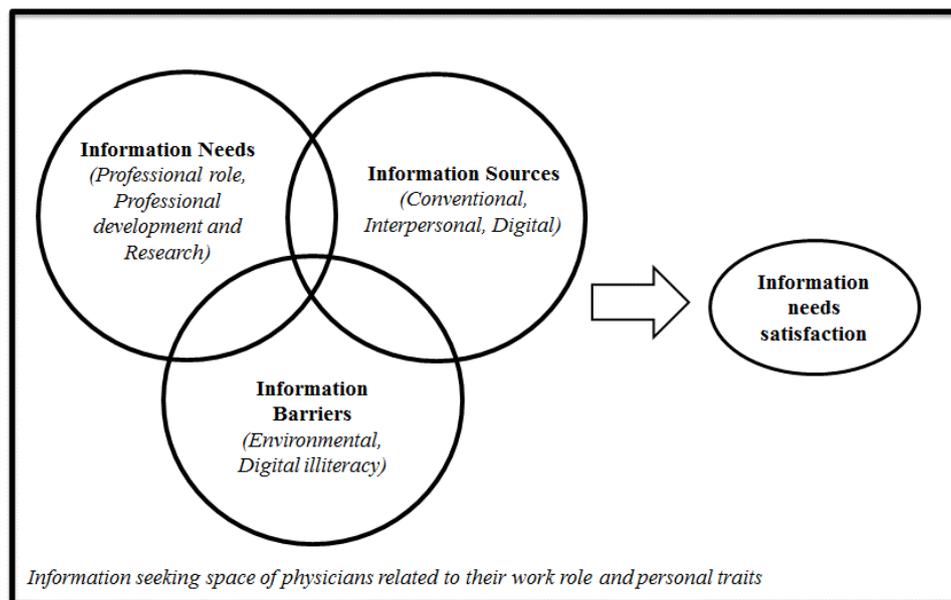
Figure 2 Conceptual model illustrating the interrelations between the information seeking behavior components

3. Research Methodology

To assess which paths lead to different levels of information satisfaction we employed the Fuzzy-Set Qualitative Comparative Analysis (fsQCA) method (Rihoux & Ragin, 2009). The family of QCA methods, also referred to as configuration or complexity theories, has been praised as suitable candidates for strategy formulation in Management Science (Fiss, 2011) and Information Systems research (El Sawy et al., 2010). Recently, scholars have applied configuration theories to explain social and behavioral science phenomena in such fields as of e-commerce (Pappas et al., 2016), online social networks (Mozas-Moral et al., 2016), and

mobile commerce (Veríssimo, 2016). Along this line, Liu et al. (Liu et al., 2015) summarized the methodological steps involved in the application of configuration theories in such research phenomena. Our research follows their recommendations and prescriptions.

Configuration theories complement popular statistical methods (e.g. structural equation modeling regression) by shedding light in research questions through a different angle. Similar to commonly used statistical methods, phenomena are viewed as a model of dependent versus independent variables. Nevertheless, the similarities discontinue after the initial modeling of the research problem.

First, the independent variables (termed as conditions) are simultaneously used to explain the outcome in question. Traditional statistical techniques assume that independent variables compete with each other to lead to the outcome of interest; that is why there is always one solution that explains the phenomenon whilst the statistical method attributes weights to the hypothesized causal variables. Configuration theories prescribe that conditions may be combined to reach the outcome of interest (Rihoux & Ragin, 2009). In this case, many solutions (i.e., combinations of the conditions) may reach the same outcome. Moreover, a condition that was not included in the optimal solution of a variance theory approach, even if linear association between this condition and the dependent variable is exhibited in the correlations matrix, may participate in one of the alternative solutions in the configuration theories paradigm. The produced solutions includes different 'paths', which commonly lead to the same outcome. Each path represents a unique combination of causal conditions, which in turn can be formulated as an intersection of sets, or causal recipes.

Furthermore, configuration theories allow researchers to model the problem based on their theoretical and contextual understanding. Researchers may now explore for conditions that are essential to guarantee high values of the examined outcome; in this spirit, several combinations of essential conditions may exist instead of the one solution that is always suggested by contemporary statistical methods. To do so, researchers need to calibrate their independent and dependent variables in order to clearly state which range of values represents high, medium, and low outcome performance. Finally, configuration theories are not restricted by assumptions imposed by the statistical method (e.g. number of cases per variable, normally distributed cases, linear association between variables and so on) making them attractive for small-sized samples.

fsQCA uses set theory and Boolean algebra to analyze the extent to which the theoretically hypothesized conditions are present or absent from the solutions that explain the phenomenon under investigation. To do so, researchers should first recode cases in terms of their membership in specific sets that describe whether a particular condition applies or not. In fsQCA terminology, fuzzy set membership scores are continuous and range from 0 to 1. Values close to 1 dictate that a case fully belongs in the set. Values close to 0 indicate non-membership to the set. The methodology also identifies a cross-over point above which a case may be interpreted as closer to membership that non-membership. In the context of our research, a membership score of 0.9 in the condition 'Usage of digital sources' implies strong confidence that the particular doctor employs the Internet to access health-related information for her information needs. Likewise, a membership score of 0.3 implies that this doctor does not use the Internet to seek health-related information. Transformation of cases is coined with the term 'calibration'. In our research we followed the prescriptions of Liu et al. (Liu et al., 2015) pertaining the calibration of latent variables per construct. We used three qualitative anchors for the calibration, (i.e., full membership threshold, full non-membership threshold, and a crossover point) based on the survey scale (5-point Likert). The full membership threshold was

fixed at the rating of 4.5; the full non-membership threshold was fixed at the rating of 1.5; and, the crossover point was fixed at 3.

An important property of fsQCA is the representation of causality. Causal conditions are expressed in terms of their necessity and sufficiency. In the case of our research, a condition is necessary if high physicians' information satisfaction cannot be derived without it. Likewise, a condition is sufficient if it can solely produce the outcome. In practice, researchers will usually uncover combinations of the hypothesized conditions as being sufficient to predict the outcome (Legewie, 2013). In this spirit, individual conditions are neither necessary nor sufficient by themselves; instead, the recipes that include these conditions are sufficient (or necessary in the case of a single produced recipe) for the outcome under investigation. The necessary and the sufficient conditions lead to a distinction between core and peripheral elements (Fiss, 2011). Core elements are the ones with a strong causal condition with the outcome; peripheral elements are those with a weaker one.

Boolean algebra is employed to pinpoint causal patterns of sufficiency. Specifically, fsQCA creates a truth table that includes all possible combinations of causal conditions and their sufficiency degree to 'predict' the dependent outcome. The truth table has 2^n rows, with n expressing the total number of causal conditions. The 'predictive power' of each combination is expressed through two measurements of fitness, namely consistency and coverage. Consistency measures the relevance of each combination with the outcome and may be interpreted as the significance index in linear regression models (Legewie, 2013). Coverage expresses the degree to which a combination explains the outcome. In terms of contemporary statistical methods, coverage resembles the variance explained in regression models. Both indexes values range between 0 and 1.

The truth table is analyzed using software that follows fsQCA calculation principles. The software calculates the consistency of each combination of causal conditions that are sufficient for the dependent outcome. Since the consistency degree of configurations varies significantly (i.e., the truth table includes configurations with high consistency degrees as well as configurations with low consistency degrees) researchers should filter the produced results by selecting for further analysis only those configurations that exhibit high degrees of consistency with the examined outcome. A value of 0.8 and above is considered as appropriate consistency threshold (Rihoux & Ragin, 2009) and was the one selected as a threshold for this study. Truth table analysis employs then Boolean minimization to pinpoint the final paths towards the outcome. The minimization process, in principle, identifies the combinations of conditions that better grasp the patterns that exist in the dataset, which lead to the desired phenomenon in scrutiny corresponding to the consistency thresholds set by the researcher. The process arrives in a set of equations that offer three solutions differing in terms of parsimony. Each solution appears as a depiction of the causally relevant conditions that are linked to the outcome using the Boolean operators AND and OR. The parsimonious solution is of interest to researchers because it includes the minimum number of paths (and conditions possible) towards the outcome. However, for purposes of results' clarity and completeness, scholars usually report a combination of the parsimonious and intermediate solutions and distinguish between core and peripheral conditions that lead to the outcome of interest (Fiss, 2011; Pappas et al., 2016). The same presentation strategy was followed in our study. Specifically, we report the intermediate solution for our high and low/ medium satisfaction paths and conditions that belong to the parsimonious solution are highlighted as core ones.

4. Research Design and Procedure

Instrument Development

The knowledge of physicians' information seeking behaviour which leads towards the satisfaction of information needs has matured over the last few decades as a result of a wide number of relevant theoretical and empirical studies (Anker et al., 2011). In this work, as explained above, the research design adopted has been informed by the theoretical approach by Wilson (2002) which is considering information seeking as a purposeful, goal-oriented approach for making better decisions. Although our approach is grounded on the aforementioned macro-model, the selected items expatiating the three main information-seeking dimensions for diabetes doctors are drawn from the relevant literature and portrayed in Table 1. The questionnaire was structured in five sections.

- The first section included questions about demographic characteristics of physicians (i.e., age, place of work, average number of patients daily).
- Information seeking behavior initiates from the recognition of information needs that are identified within a particular setting, namely the role and the professional environment of diabetes medical doctors. Questions included in the second section addressed the multiplicity of information needs identified in relation to their professional role (e.g. diagnosis, therapy, education etc).
- Within the information universe the medical doctors are in contact with a number of different information resources including other persons (e.g. other doctors, patients) and "information technology" systems, including the internet. This section addressed the utilization of digital, conventional and interpersonal information resources.
- The fourth section of the questionnaire assessed the importance of intervening variables (barriers/ obstacles) to information seeking which may be personal, interpersonal and environmental (e.g. lack of time, cost, lack of computer skills).
- The fifth section is related to the satisfaction of information needs within the particular information environment.

Table 1: Questionnaire dimensions and associated measurement items

Questionnaire Dimensions	Definition/ Explanation	Instrument items	Sources
Information needs	Measures the degree to which specific issues and topics are engaged when medical doctors are seeking information.	Diagnosis, treatment, information about medication, epidemiology, educational material for patients, research, teaching	Davies (2011b) Gonzalez- Gonzalez et al (2007) Bennett et al (2004) Bryant (2004)
Information resources	Measures the degree to which specific information resources are employed by medical doctors when seeking information with their professional role. The information resources can be interpersonal, conventional and digital.	Personal library, hospital medical library, printed medical magazines, digital medical databases, digital search engines, medical associations' webpages, online updating services, guidelines, digital journals, personal communication with colleagues/ experts, medical conferences/ workshops/ events, pharmaceutical representatives	Davies (2011a) Davies (2011b) Younger (Younger, 2010) Del Fiol & Haug (2008) Gonzalez- Gonzalez et al (2007) Bennett et al (2004) Cogdill (2003)
Barriers toward seeking information	Measures the perceived obstacles when medical	Time constraints, cost, lack of information services,	Adams et al (2007) Ely et al (2005)

	doctors are seeking information. The obstacles can arise from the work environment or can be related to doctor's information literacy skills.	lack of familiarity with ways to search for information, lack of familiarity with computers/ software, mistrust on electronic information, difficult to comprehend information presented in foreign language	

A 5-point Likert scale was used to rate the importance of information needs (8-items), frequency of information resources (12-items) utilization, the importance of barriers involved in seeking information (8-items) and finally the information satisfaction (single-item measurement). The values assigned to the five item Likert scale were ranging from 1= "not at all" which was indicating the lowest score to 5= "a lot" which was assigned to the highest score. The research instrument and the descriptive statistics are included in the Appendix. Prior to its distribution, the questionnaire was pretested for content validity by a group of experts from both the diabetes and the information science academic community.

Survey administration and respondents profile

The data of this study were collected by means of a questionnaire survey, which was distributed to the Hellenic Diabetic Association (HDA) members who had registered an e-mail address. The questionnaire was also electronically uploaded to the HDA webpage (http://www.ede.gr). In addition, the questionnaire was administered to the participants of the Pan-Hellenic Diabetes Conference, which was held in Athens. Medical practitioners who attended the conference could fill in the questionnaire in the conference's secretariat. The association's administration staff ensured research protocol adherence and prevented duplicate responses. Responses were equally distributed between the offline and online version of the questionnaire. The survey was approved by the scientific committee of the HDA.

Overall, 159 medical physicians participated in our study out of the 700 questionnaires that were distributed primarily through e-mail to registered HDA users resulting to a response rate of almost 23%. The majority of the sample comprised of relative young physicians (up to 50 years old – 89.9% of the sample) that have completed their specialization (83% of the sample) and were practicing pathology or general medicine (85.5% of the sample). Almost 60% of the study participants were working on a public hospital or social security healthcare center. The sample exhibited equal representation of specialized physicians on diabetes mellitus and non-specialized ones. Moreover, 70% of the sample was treating, on average, more than six patients on a daily basis.

5. Results and analysis

Grouping of information needs, sources and obstacles

This section deals with the grouping of the main three areas of interest for our research, information seeking needs or motives (e.g. diagnosis, treatment, information about medication, research), information sources (e.g. personal library, printed medical magazines, digital scientific medical databases, digital search engines) and the obstacles encountered during the information seeking process (e.g. time constraints, cost, lack of familiarity with computers/software) using principal components factor analysis with Varimax rotation. The output of this process is included in the following table.

Table 2: Principal components analysis results for the study constructs. (Legend: 1- Professional Role, 2- Professional Development & Research, 3-Conventional Sources, 4-Digital Sources, 5-Interpersonal Sources, 6- Environmental Barriers, 7- Digital Illiteracy)

Items	Factor						
	1	2	3	4	5	6	7
Information Needs							
Diagnosis	.640						
Treatment	.863						
Information about medication	.836						
Epidemiology		.697					
Educational material for patients		.605					
Research		.849					
Teaching material		.881					
Information Sources							
Personal library			.741				
Hospital medical library			.654				
Printed medical magazines			.516				
Digital medical databases (e.g. pubmed)				.866			
Digital search engines (e.g. Google)				.643			
Medical Associations' webpages (e.g. ADA)				.697			
Online updating services				.767			
Medical Guidelines				.671			
Digital journals (e.g. Diabetes Care, BMJ)				.701			
Personal communication with colleagues/ experts					.765		
Medical conferences/ workshops/ events					.758		
Pharmaceutical representatives					.664		
Information Barriers							
Time constraints						.758	
Cost						.728	
Lack of information services (e.g. access to online libraries)						.527	
Lack of familiarity with ways to search for information							.878
Lack of familiarity with computers/ software							.846
Mistrust on electronic information							.793
Difficult to comprehend information presented in foreign language							.772

Following the outcomes of the principal component analyses outlined above, Table 3 presents the descriptive statistics of the examined dimensions for the entire sample.

Table 3: Descriptive statistics

	Mean (N=159)	Std. Deviation
Information Needs		
Professional Role	4.28	.80
Professional Development & Research	3.29	1.06
Information Sources		
Digital	3.79	.92
Conventional	3.15	.87
Interpersonal	3.31	.77
Information Barriers		
Environmental	3.35	.94

	2.08	.97
Lack of Information/Digital literacy	2.08	.97
Information Satisfaction		
Overall Satisfaction	3.55	.79

The paths to information satisfaction

Table 4 presents the fsQCA results for the high satisfaction paths. The analysis suggests that there are five (5) alternative solutions that ultimately lead to high information satisfaction for medical physicians of diabetes mellitus. The (required) presence of a condition in each solution is indicated with a black circle. White circles indicate the (required) absence of a condition. Blank cells indicate that the presence or absence of a condition does not affect the outcome. Large circles indicate core conditions whilst small ones, indicate peripheral conditions. The consistency row estimates the degree to which the empirical evidence is consistent with the outcome under investigation (i.e. the degree to which each solution always leads to high degrees of information satisfaction). All solutions as well as the overall solution exhibit very high consistency. Values above 0.70 represent acceptable consistency thresholds (Fiss, 2011). The coverage rows indicate the proportion of cases leading to the desired outcome.

Table 4: fsQCA results illustrating paths leading to high information satisfaction

	Solutions				
Conditions	**1**	**2**	**3**	**4**	**5**
Information Needs					
Professional Role	●	●		●	●
Professional Development & Research		●	○		○
Information Sources					
Conventional	○		○	●	●
Interpersonal	○		○	●	○
Digital	●	●	●	●	○
Information Barriers					
Environmental		○	○	●	●
Digital Illiteracy	○	○	○	○	○
Consistency	0.812	0.873	0.817	0.818	0.805
Coverage	0.442	0.384	0.279	0.212	0.112
Overall solution consistency	0.779				
Overall solution coverage	0.670				

Of particular interest in the findings is the evident role of digital sources for a satisfactory outcome in relation to information needs, which concern activities that have to do with both professional role and professional development & research tasks. In fact, digital sources feature in four out of five of the information satisfaction solutions and in the majority of the cases they also require low or indifferent usage of other conventional and interpersonal resources. These findings confirm the reported uprise on the utilization of online resources by medical professionals and suggest that they have transcended into their primary information source (MacWalter et al., 2016; Younger, 2010). Interestingly, conventional information sources (i.e., offline, printed, books and magazines) are also prevalent in satisfying physicians information needs related to their work role (i.e., diagnosis and treatment) as evinced by solutions 4 and 5. However, such information sources are preferred by individuals that exhibit environmental or personal obstacles in the form of time constraints and lack of access to online libraries. Another interesting result relates to the uniform requirement for digital skills, which is included in all

fsQCA paths. We discuss this finding in more detail in the practical implications section in which we also outline the importance of the Internet to satisfy physicians' information needs. On the other hand, conventional sources are presented in the information satisfaction path in two solutions while the use of interpersonal sources is more likely to be at a low level to achieve a high satisfaction condition.

Having identified the combinations of conditions that lead to high information satisfaction we turn our attention to exploring the paths that lead to low or medium information satisfaction. Similar to the high information satisfaction paths, fsQCA reveals five solutions, which are illustrated in Table 5. Interestingly, DM physicians perceive low degrees of satisfaction primarily for needs related to their professional role as evinced in four out of the five produced solutions. We distinct the reasons for this behavior into two major categories based on the fsQCA results portfolio. On the one hand, DM physicians perceive poor information needs satisfaction when they do not use online/ digital information resources (illustrated as core condition in solutions 1-3) coupled with the presence of environmental and personal barriers. On the other hand, poor information needs satisfaction also occurs when DM physicians exhibit one or both information barriers (solutions 4 and 5). In these cases, even if DM physicians use almost all types of information sources to satisfy their information needs, the inherent barriers are strong enough to negatively influence the overall satisfaction from the accumulated information.

Table 5: fsQCA results illustrating paths leading to low information satisfaction

	Solutions				
Conditions	**1**	**2**	**3**	**4**	**5**
Information Needs					
Professional Role	●		●	●	●
Professional Development & Research	○	○	○	○	●
Information Sources					
Conventional	○	○			●
Interpersonal		○	○	●	●
Digital	○	○	○	●	●
Information Barriers					
Environmental		●	●	●	●
Digital Illiteracy	○	○	○	○	●
Consistency	0.802	0.837	0.829	0.848	0.887
Coverage	0.329	0.227	0.219	0.212	0.074
Overall solution consistency	0.791				
Overall solution coverage	0.500				

6. Discussion

Summary of theoretical and practical contribution

The findings of our research demonstrate that there are a number of necessary conditions, which lead to information satisfaction: the use of digital sources, the elimination of environmental barriers (such as the lack of time) and the existence of information and digital literacy. Hence, this study provides an explanatory lens on the conditions leading healthcare professionals to choose among different information sources to satisfy their information needs. We posit that our work provides significant contribution in terms of improving clinical

decision-making and medical practice as well as advancing scholars' theoretical understanding of the conditions that underpin physicians' information seeking behaviour. Indeed, our theoretical model and associated investigation methodology constitutes a self-reported toolkit that guides medical doctors to selecting the most appropriate health information sources based on their contextual information needs and inherent capabilities (i.e., personal or environmental information barriers). The toolkit produces multiple recipes that warrant high information needs satisfaction.

So far, physicians' selection process of information sources was informed primarily by convenience (Bryant, 2004; Coumou & Meijman, 2006; Kosteniuk et al., 2013), familiarity with sources (Verhoeven et al., 1995), trustworthiness towards sources (Hughes et al., 2009; Kostagiolas et al., 2014), and sources quality (Dawes & Sampson, 2003). Our work provides an alternative viewpoint in physicians' information seeking behaviour. Having established their information needs, this study proposes suitable information strategies to medical professionals taking into account their perceived information barriers thus, minimizing any risks or uncertainties pertaining the expected value that these individuals will receive from an information source. This is particularly significant for the paths recommending the use of digital sources since physicians appear to be less confident with their online information searching competencies (Metzger & Flanagin, 2011). Likewise, the prescriptions of our model also include the information sources that physicians should avoid because they are either incompatible with their current information needs or they require skills which are not attainable by individuals. These recipes are incorporated in the paths that produce low degrees of information satisfaction.

Along this line, our research also highlights the fitness of use among health information needs and online versus offline information resources. To our knowledge, this is the first study that empirically determines logical links between information needs, barriers and sources. However, these links are not uni-dimensional. Instead, our work reveals that under certain conditions (i.e., combination of needs, barriers and sources) physicians' environmental and information-related inefficiencies may play pivotal or trivial role in determining the degree of information satisfaction for medical professionals, especially in the case of online information sources. It should be noted that depending on the level of desired detail, our methodology may produce further insights. Specifically, we employed a macro-level perspective to identify the recipes that lead to high degrees of health information satisfaction, by consolidating the needs, barriers, and sources into specific categories. Alternatively, researchers may adopt a micro-level investigation stance in which the specific needs, barriers, and sources (in the form of the measurement items) are all included in fsQCA and analyzed to produce the same objectives. Of course, this course of action will harvest many more paths, which would require scrutiny by the researcher to homogenize them and result to useful and actionable findings.

Furthermore, this research paves the ground for the development of theories explaining physicians' information channel preferences and the accumulated information satisfaction from a health information channel (i.e., offline versus online information channels) or a particular information source. Especially in the case of information technologies and the Internet in particular, information systems literature has generated a large body of knowledge that gravitates towards explaining the adoption of online services/ systems in isolation. Theoretical frameworks rely on disconfirmation theories principles [e.g. the Expectation-Confirmation paradigm (Venkatesh et al., 2011)) or information technology properties (e.g. the second iteration of the Unified Theory of Adoption and Use of Technology (Venkatesh et al., 2012)] to predict individuals' satisfaction and/ or adoption of a specific technology innovation.

However, research has yet to consider the underlying motives that lead individuals to choose among competing information channels (or sources) as a means to accomplish their goals. This research substantiated the pivotal role of information needs and barriers towards the selection of appropriate information sources that warrant information satisfaction for medical professionals. Interestingly, Au et al (2008) follow a similar approach in combining needs theory, equity theory, and expectation-confirmation theory to explain individuals' satisfaction of organizational information systems in the hotel and airline industries. To make progress towards the formulation of new models explaining the selection of health information choices for medical physicians, researchers should first theorize about the unique aspects driving the selection process and the properties that differentiate the competing alternatives. We propose that information needs constitute a noteworthy motivation factor hence, they should be included at the core of theory formulation.

From a practical standpoint, the paths to information needs satisfaction can further drive medical and clinical information scientists to the development of specialized library and information services for DM medical doctors or for physicians of other specialties. These services may include the development of doctor-oriented digital healthcare network technologies and patient medical records based on doctors' specific paths to information satisfaction profile starting with their information needs. The development of these profiles could also inform the design of new medical information portals and search engines or the improvement of existing ones regarding the implementation of personalization algorithms that would better guide professionals to appropriate information sources based on their inherent needs.

Moreover, this notion of paths to the satisfaction of information needs introduces a stream of research for comprehending the impact of information seeking behaviours in a participatory clinical decision making framework. Amalgamating the paths to information satisfaction of the physicians and the patients can provide a common ground for better patient-physician communication and thus better clinical decisions. This in turn may have a direct impact on the quality of healthcare service provision and improve the clinical outcomes.

The role of the Internet on health information satisfaction

Comparing the information satisfaction trajectories we explored in this study to the findings related to the general information seeking behaviour of health professionals from earlier research, a number of interesting conclusions emerge. In our study, digital sources (such as online scientific databases and search engines) were the most popular information sources used by diabetes physicians. In addition, DM physicians in our research were mostly satisfied with using digital information sources, whereas interpersonal and conventional sources were not considered as equally important in their information satisfaction paths. It can be overall observed that only one of the 'high' information satisfaction paths includes a combination of digital, conventional and interpersonal sources concurrently. It is also evident that DM physicians balance the potential benefits of using specific information sources according to related environmental (e.g. time, cost) and personal/ environmental barriers (e.g. information and digital literacy) to information seeking. Thus in our satisfaction scenarios, information resources may be viewed as 'competing' in the diabetes physicians' 'preferences' rather complementing each other. In fact, it is but in one satisfaction path (solution 4) that digital resources are utilized without requiring low use of other resources (either conventional or interpersonal) in order to lead to a successful result.

Satisfaction of specific information needs of diabetes physicians may therefore require the use of one but not a combination of information resources. This may explain why "research consistently shows that the clinical information needs of health professionals are not being adequately met, specifically regarding evidence-based information (EB)" (Model Systems Knowledge Translation Center, 2010). Thus, while a lot of effort and focus has been given to studying the information seeking behaviour and use of health information for patient care and clinical decision-making, more emphasis should be given to specific mechanisms for providing systematic information literacy training to health professionals in order to increase effective use of the variety of information sources available to them, which may lead to higher satisfaction with a variety of sources and therefore better evidence-based practice.

7. Conclusions, limitations, and future work

The analysis above provides evidence for the informational behaviour of physicians that lead (or not) to information needs satisfaction. In view of our findings, the information needs arise as a result of DM physicians' professional patient care centered responsibilities (diagnosis, treatment and information about medication) and other professional development and research based tasks (e.g. epidemiology, patients' education, research and teachings). Thus in this framework, DM physicians assume a role beyond the health information exchange for symptoms, diagnosis, and therapy with patients. Their role also includes information interactions with patients integral to the healthcare service provision. These patient-physician interfaces draw information from complex social networks and other activities, which involve communication skills professional development and continuing learning. As we have explained, ideally, an overall "successful" information seeking path which would lead to information satisfaction for diabetes physicians would include the use of a variety of information resources (digital, conventional and interpersonal) and the elimination of potential barriers (environmental, information and digital literacy) when seeking information. However, as we concluded from the findings of our study, DM physicians' information needs were mostly satisfied via an information seeking path which involved digital resources (mainly online databases and search engines) and considered the role of information and digital literacy as an essential contributing factor. However, the fact that diabetes physicians demonstrated preference towards a single information source does not eliminate their need to take full advantage of all other resources.

It should be noted that the information satisfaction paths quite interestingly suggest that information availability does not necessarily imply better informed physicians and one should use the behavioural perspective as one of the points of departure. As the world of online health information changes around medical professionals the study of physicians' paths to satisfaction of information needs, should be the starting point for the rise of sophisticated interventions to traditional healthcare settings. Indeed, these paths should be studied for a wide range of specific medical specialities and/ or clinical environments in order to provide broader predictive judgements for healthcare information services design.

As with any empirical research, our findings should be interpreted under the auspices of our study limitations. In effect, our instrument variables were measured through self-reported items. Future research may employ observed measures (e.g. measurement of information needs based on physicians' search patterns in medical search engines, measurement of information literacy based on physicians' errors during the online search process, and so on). Moreover, younger physicians are over-represented in our sample. An extended sample, which includes older age groups would address limitations of the research related with the accurate

representation of all ages. Likewise, although this study is focused on DM physicians, future research may replicate our methodology to capture the information satisfaction paths of medical professionals in general and reveal possible similarities or deviations from our findings. Along this line, our research offers insights on how the information search behaviour components combine to explain medical doctors' information needs satisfaction. Future work may experiment on explaining if and under what circumstances, one or more conditions dominate or neutralized the others. Furthermore, future research may explore the influence of personal (e.g., age, gender, and years of practice) or contextual factors (e.g. size of the organization, the workplace, such as private, public, or university hospital, and the complexity of patients) to the formulation of information needs, selection of information sources, and overall information satisfaction. Finally, although our research emphasized on preventive factors in the form of 'information barriers', we acknowledge that future research should also specifically explore the influence of supportive factors (e.g. facilitating conditions) to the information seeking behaviour of physicians.

References

ADAMS, ANN, ADAMS, RACHEL, THOROGOOD, MARGARET, & BUCKINGHAM, CHRISTOPHER. (2007) Barriers to the use of e-health technology in nurse practitionerpatient consultations. Informatics in primary care, 15(2): 103-109.

ANKER, ASHLEY E., REINHART, AMBER MARIE, & FEELEY, THOMAS HUGH. (2011) Health information seeking: A review of measures and methods. Patient Education and Counseling, 82(3): 346-354.

AU, NORMAN, NGAI, ERIC W. T., & CHENG, T. C. EDWIN. (2008) Extending the understanding of end user information systems satisfaction formation: An equitable needs fulfillment model approach. MIS Quarterly, 32(1): 43-66.

BAWDEN, DAVID. (2006) Users, user studies and human information behaviour: A three-decade perspective on Tom Wilson's "On user studies and information needs". Journal of Documentation, 62(6): 671-679.

BAWDEN, DAVID, & ROBINSON, LYN. (2009) The dark side of information: overload, anxiety and other paradoxes and pathologies. Journal of information science, 35(2): 180-191.

BENNETT, NANCY L, CASEBEER, LINDA L, KRISTOFCO, ROBERT E, & STRASSER, SHERYL M. (2004) Physicians' Internet information-seeking behaviors. Journal of Continuing Education in the Health Professions, 24(1): 31-38.

BENNETT, NANCY L., CASEBEER, LINDA L., ZHENG, SHIMIN, & KRISTOFCO, ROBERT. (2006) Information-seeking behaviors and reflective practice. Journal of Continuing Education in the Health Professions, 26(2): 120-127.

BEVERLEY, CA, BATH, PA, & BARBER, R. (2007) Can two established information models explain the information behaviour of visually impaired people seeking health and social care information? Journal of Documentation, 63(1): 9-32.

BOUWMAN, HARRY, & VAN DE WIJNGAERT, LIDWIEN. (2002) Content and context: An exploration of the basic characteristics of information needs. New Media & Society, 4(3): 329-353.

BREZ, SHARON, ROWAN, MARGO, MALCOLM, JANINE, IZZI, SHERYL, MARANGER, JULIE, LIDDY, CLARE, KEELY, ERIN, & OOI, TEIK C. (2009) Transition from specialist to primary diabetes care: A qualitative study of perspectives of primary care physicians. BMC family practice, 10(1): 39.

BRYANT, SUE LACEY. (2004) The information needs and information seeking behaviour of family doctors. Health Information & Libraries Journal, 21(2): 84-93.

CASE, DONALD OWEN. (2012) *Looking for information: A survey of research on information seeking, needs and behavior*: Emerald Group Publishing.

CLARKE, MARTINA A., BELDEN, JEFFERY L., KOOPMAN, RICHELLE J., STEEGE, LINSEY M., MOORE, JOI L., CANFIELD, SHANNON M., & KIM, MIN S. (2013) Information needs and information-seeking behaviour analysis of primary care physicians and nurses: a literature review. Health Information & Libraries Journal, 30(3): 178-190.

COGDILL, KEITH W. (2003) Information needs and information seeking in primary care: a study of nurse practitioners. Journal of the Medical Library Association, 91(2): 203.

COUMOU, HERMA C. H., & MEIJMAN, FRANS J. (2006) How do primary care physicians seek answers to clinical questions? A literature review. Journal of the Medical Library Association, 94(1): 55.

DAVIES, K. (2011a) Information Needs and Barriers to Accessing Electronic Information: Hospital-Based Physicians Compared to Primary Care Physicians. Journal of Hospital Librarianship, 11(3): 249-260.

DAVIES, K. (2011b) Physicians and their use of information: a survey comparison between the United States, Canada, and the United Kingdom. Journal of the Medical Library Association: JMLA, 99(1): 88.

DAVIES, K., & HARRISON, J. (2007) The information-seeking behaviour of doctors: a review of the evidence. Health Information and Libraries Journal, 24(2): 78-94.

DAWES, MARTIN, & SAMPSON, UCHECHUKWU. (2003) Knowledge management in clinical practice: a systematic review of information seeking behavior in physicians. International journal of medical informatics, 71(1): 9-15.

DEL FIOL, GUILHERME, & HAUG, PETER J. (2008) Infobuttons and classification models: A method for the automatic selection of on-line information resources to fulfill clinicians' information needs. Journal of biomedical informatics, 41(4): 655-666.

DERVIN, BRENDA, FOREMAN-WERNET, LOIS, & LAUTERBACH, ERIC. (2003) *Sense-making methodology reader: Selected writings of Brenda Dervin*: Hampton Pr.

EDEN, KAREN B, TOTTEN, ANNETTE M, KASSAKIAN, STEVEN Z, GORMAN, PAUL N, MCDONAGH, MARIAN S, DEVINE, BETH, PAPPAS, MIRANDA, DAEGES, MONICA, WOODS, SUSAN, & HERSH, WILLIAM R. (2016) Barriers and facilitators to exchanging health information: a systematic review. International journal of medical informatics, 88: 44-51.

EL SAWY, OMAR A, MALHOTRA, ARVIND, PARK, YOUNGKI, & PAVLOU, PAUL A. (2010) Seeking the Configurations of Digital Ecodynamics: It Takes Three to Tango. Information Systems Research, 21(4): 835-848.

ELY, JOHN W, OSHEROFF, JEROME A, CHAMBLISS, M LEE, EBELL, MARK H, & ROSENBAUM, MARCY E. (2005) Answering physicians' clinical questions: obstacles and potential solutions. Journal of the American Medical Informatics Association, 12(2): 217-224.

FIGUEIRAS, ADOLFO, CAAMAÑO, FRANCISCO, & GESTAL-OTERO, JESUS JUAN. (2000) Influence of physician's education, drug information and medical-care settings on the quality of drugs prescribed. European Journal of Clinical Pharmacology, 56(9): 747-753.

FISS, PEER C. (2011) Building better causal theories: A fuzzy set approach to typologies in organization research. Academy of Management Journal, 54(2): 393-420.

GIKAS, ARISTOFANIS, SOTIROPOULOS, ALEXIOS, POLITAKIS, PETROS, SPANOU, ELENI, APOSTOLOU, OURANIA, & PAPPAS, STAVROS. (2006) Level of glycaemic and lipid control among diabetic patients in Greek primary care. European Journal of General Practice, 12(4): 181-182.

GONZÁLEZ-GONZÁLEZ, ANA I, DAWES, MARTIN, SÁNCHEZ-MATEOS, JOSÉ, RIESGO-FUERTES, ROSARIO, ESCORTELL-MAYOR, ESPERANZA, SANZ-CUESTA, TERESA, & HERNÁNDEZ-

FERNÁNDEZ, TOMÁS. (2007) Information needs and information-seeking behavior of primary care physicians. The Annals of Family Medicine, 5(4): 345-352.

GREYSON, DEVON L., CUNNINGHAM, COLLEEN, & MORGAN, STEVE. (2012) Information behaviour of Canadian pharmaceutical policy makers. Health Information & Libraries Journal, 29(1): 16-27.

HERTZUM, MORTEN, & PEJTERSEN, ANNELISE MARK. (2000) The information-seeking practices of engineers: searching for documents as well as for people. Information Processing & Management, 36(5): 761-778.

HESSE, BRADFORD W, NELSON, DAVID E, KREPS, GARY L, CROYLE, ROBERT T, ARORA, NEERAJ K, RIMER, BARBARA K, & VISWANATH, KASISOMAYAJULA. (2005) Trust and sources of health information: the impact of the Internet and its implications for health care providers: findings from the first Health Information National Trends Survey. Archives of internal medicine, 165(22): 2618-2624.

HOU, JIRAN, & SHIM, MINSUN. (2010) The role of provider–patient communication and trust in online sources in Internet use for health-related activities. Journal of Health Communication, 15(sup3): 186-199.

HUGHES, BENJAMIN, JOSHI, INDRA, LEMONDE, HUGH, & WAREHAM, JONATHAN. (2009) Junior physician's use of Web 2.0 for information seeking and medical education: A qualitative study. International Journal of Medical Informatics, 78(10): 645-655.

JIANG, SHAOHAI, & BEAUDOIN, CHRISTOPHER E. (2016) Health literacy and the internet: An exploratory study on the 2013 HINTS survey. Computers in Human Behavior, 58: 240-248.

JOHNSON, FRANCES, ROWLEY, JENNIFER, & SBAFFI, LAURA. (2015) Modelling trust formation in health information contexts. Journal of Information Science, 41(4): 415-429.

KOSTAGIOLAS, PETROS, KORFIATIS, NIKOLAOS, KOUROUTHANASIS, PANOS, & ALEXIAS, GEORGIOS. (2014) Work-related factors influencing doctors search behaviors and trust toward medical information resources. International Journal of Information Management, 34(2): 80-88.

KOSTAGIOLAS, PETROS, MARTZOUKOU, KONSTANTINA, GEORGANTZI, GEORGIA, & NIAKAS, DIMITRIS. (2013) Information seeking behaviour of parents of paediatric patients for clinical decision-making: the central role of information literacy in a participatory setting. Information Research, 18(3).

KOSTENIUK, J.G., MORGAN, G.D., & D'ARCY, C.K. (2013) Use and perceptions of information among family physicians: sources considered accessible, relevant, and reliable. Journal of the Medical Library Association, 101(1): 32-37.

KUHLTHAU, CAROL C, HEINSTRÖM, JANNICA, & TODD, ROSS J. (2008) The 'information search process' revisited: Is the model still useful. Information Research, 13(4): 13-14.

KUNDA, ZIVA. (1999) *Social cognition: Making sense of people*: MIT press.

LEGEWIE, N. (2013) An Introduction to Applied Data Analysis with Qualitative Comparative Analysis (QCA). Forum: Qualitative Social Research, 14(3): Article 15.

LI, YUELIN, & BELKIN, NICHOLAS J. (2010) An exploration of the relationships between work task and interactive information search behavior. Journal of the American Society for Information Science and Technology, 61(9): 1771-1789.

LIU, YONG, MEZEI, JÓZSEF, KOSTAKOS, VASSILIS, & LI, HONGXIU. (2015) Applying configurational analysis to IS behavioural research: a methodological alternative for modelling combinatorial complexities. Information Systems Journal, (Online early view).

MacWalter, Gordon, McKay, John, & Bowie, Paul. (2016) Utilisation of internet resources for continuing professional development: a cross-sectional survey of general practitioners in Scotland. BMC medical education, 16(1): 1.

Martzoukou, Konstantina. (2005) A review of Web information seeking research: Considerations of method and foci of interest. Information Research, 10(2): paper 215.

Masters, Ken. (2008) For what purpose and reasons do doctors use the Internet: a systematic review. International Journal of Medical Informatics, 77(1): 4-16.

Metzger, Miriam J, & Flanagin, Andrew J. (2011) Using Web 2.0 technologies to enhance evidence-based medical information. Journal of health communication, 16(sup1): 45-58.

Model Systems Knowledge Translation Center. (2010). *Information Needs of Health Professionals - Literature Review Summary* (pp. 4). Retrieved from http://uwmsktc.washington.edu/HealthProfessional_InfoNeeds.pdf

Mozas-Moral, Adoración, Bernal-Jurado, Enrique, Medina-Viruel, Miguel Jesús, & Fernández-Uclés, Domingo. (2016) Factors for success in online social networks: An fsQCA approach. Journal of Business Research, (Online early view).

Olatokun, Wole Michael, & Ajagbe, Enitan. (2010) Analyzing traditional medical practitioners' information-seeking behaviour using Taylor's information-use environment model. Journal of Librarianship and Information Science, 42(2): 122-135.

Ordanini, Andrea, Parasuraman, Ananthanarayanan, & Rubera, Gaia. (2013) When the recipe is more important than the ingredients a qualitative comparative analysis (QCA) of service innovation configurations. Journal of Service Research: 1094670513513337.

Pappas, Ilias O, Kourouthanassis, Panos E, Giannakos, Michail N, & Chrissikopoulos, Vassilios. (2016) Explaining online shopping behavior with fsQCA: The role of cognitive and affective perceptions. Journal of Business Research, 69(2): 794-803.

Pluye, Pierre, Grad, Roland, Repchinsky, Carol, Jovaisas, Barbara, Johnson-Lafleur, Janique, Carrier, Marie-Eve, Granikov, Vera, Farrell, Barbara, Rodriguez, Charo, & Bartlett, Gillian. (2013) Four levels of outcomes of information-seeking: A mixed methods study in primary health care. Journal of the American Society for Information Science and Technology, 64(1): 108-125.

Rihoux, Benoît, & Ragin, Charles C. (2009) *Configurational comparative methods: Qualitative comparative analysis (QCA) and related techniques*: Sage.

Rudin, Robert S, Motala, Aneesa, Goldzweig, Caroline L, & Shekelle, Paul G. (2014) Usage and effect of health information exchange: a systematic review. Annals of internal medicine, 161(11): 803-811.

Savolainen, Reijo. (2006) Information use as gap-bridging: The viewpoint of sense-making methodology. Journal of the American Society for Information Science and Technology, 57(8): 1116-1125.

Savolainen, Reijo. (2012) Conceptualizing information need in context. Information Research, 17(4): 1-10.

Savolainen, Reijo. (2015) The interplay of affective and cognitive factors in information seeking and use: Comparing Kuhlthau's and Nahl's models. Journal of Documentation, 71(1): 175-197.

Simon, Herbert A. (1957) Models of man; social and rational.

Spink, Amanda, & Cole, Charles. (2007) Information behavior: A socio-cognitive ability. Evolutionary Psychology, 5(2): 147470490700500201.

SPINK, AMANDA, FOSTER, ALLEN, PRABHA, CHANDRA, SILIPIGNI CONNAWAY, LYNN, OLSZEWSKI, LAWRENCE, & JENKINS, LILLIE R. (2007) What is enough? Satisficing information needs. Journal of Documentation, 63(1): 74-89.

TIERNEY, WILLIAM M. (2001) Improving clinical decisions and outcomes with information: a review. International journal of medical informatics, 62(1): 1-9.

TUSTIN, NUPUR. (2010) The role of patient satisfaction in online health information seeking. Journal of health communication, 15(1): 3-17.

VENKATESH, VISWANATH, THONG, JAMES Y. L., CHAN, FRANK K. Y., HU, PAUL JEN-HWA, & BROWN, SUSAN A. (2011) Extending the two-stage information systems continuance model: incorporating UTAUT predictors and the role of context. Information Systems Journal, 21(6): 527-555.

VENKATESH, VISWANATH, THONG, JAMES Y. L., & XU, XIN. (2012) Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. MIS quarterly, 36(1): 157-178.

VERHOEVEN, ANITA A., BOERMA, EDZARD J., & MEYBOOM-DE JONG, BETTY. (1995) Use of information sources by family physicians: a literature survey. Bulletin of the Medical Library Association, 83(1): 85.

VERÍSSIMO, JOSÉ MANUEL CRISTÓVÃO. (2016) Enablers and restrictors of mobile banking app use: A fuzzy set qualitative comparative analysis (fsQCA). Journal of Business Research, (Online early view).

WANZER, MELISSA BEKELJA, BOOTH-BUTTERFIELD, MELANIE, & GRUBER, KELLY. (2004) Perceptions of health care providers' communication: relationships between patient-centered communication and satisfaction. Health communication, 16(3): 363-384.

WILSON, THOMAS D, FORD, NIGEL J, ELLIS, DAVID, FOSTER, ALLEN E, & SPINK, AMANDA. (2002) Information seeking and mediated searching: Part 2. Uncertainty and its correlates. Journal of the American society for Information Science and Technology, 53(9): 704-715.

WILSON, THOMAS DANIEL. (1997) Information behaviour: an interdisciplinary perspective. Information Processing & Management, 33(4): 551-572.

WILSON, THOMAS DANIEL. (2006) On user studies and information needs. Journal of documentation, 62(6): 658-670.

WOODSIDE, ARCH G. (2013) Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory. Journal of Business Research, 66(4): 463-472.

YEAGER, VALERIE A, WALKER, DANIEL, COLE, EVAN, MORA, ARTHUR M, & DIANA, MARK L. (2014) Factors related to health information exchange participation and use. Journal of medical systems, 38(8): 1-9.

YOUNGER, PAULA. (2010) Internet-based information-seeking behaviour amongst doctors and nurses: a short review of the literature. Health Information & Libraries Journal, 27(1): 2-10.

Appendix – Research Instrument and Descriptive Statistics

A. Please indicate the importance of the following needs that drive you to seek medical information regarding DM? (1='Not at all important', 5='Very important')

	Mean	SD
Diagnosis	3.94	1.26
Treatment	4.47	.879
Information about medication	4.41	.791
Epidemiology	3.18	1.20
Educational material for patients	3.29	1.22
Research	3.46	1.35
Teaching material	3.12	1.38

B. Please indicate the degree to which you employ the following information sources to seek medical information regarding DM? (1='Not at all', 5='A lot')

	Mean	SD
Personal library	3.57	1.14
Hospital medical library	2.08	1.30
Printed medical magazines	3.62	1.07
Digital medical databases (e.g. pubmed)	4.01	1.21
Digital search engines (e.g. Google)	3.80	1.20
Medical Associations' webpages (e.g. ADA)	3.69	1.23
Online updating services	3.47	1.39
Medical Guidelines	3.92	1.20
Digital journals (e.g. Diabetes Care, BMJ)	3.76	1.14
Personal communication with colleagues/ experts	3.35	1.15
Medical conferences/ workshops/ events	4.01	.845
Pharmaceutical representatives	2.55	1.09

C. Please indicate the importance that you attribute in the following factors influencing your capability of seeking medical information regarding DM? (1='Not at all important', 5='Very important')

	Mean	SD
Time constraints	3.81	1.20
Cost	2.83	1.34
Lack of information services (e.g. access to online libraries)	3.31	1.35
Lack of familiarity with ways to search for information	2.24	1.20
Lack of familiarity with computers/ software	1.89	1.16
Mistrust on electronic information	2.11	1.18
Difficult to comprehend information presented in foreign language	2.08	1.07

D. Please indicate the degree of satisfaction from your current capability of seeking medical information regarding DM? (Single item variable; 1=Not at all satisfied', 5='Very satisfied')

	Mean	SD
Overall Information Satisfaction	3.55	.78