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Towards a comprehensive understanding of health information needs

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Abstract
Healthcare organisations are increasingly developing and deploying Health Information Systems that target healthcare consumers. To ensure effective and engaging Health Information Systems requires identifying the potential information needs of these consumers. However a comprehensive systematic understanding of their information needs is lacking. This paper proposes a conceptual framework based on Luft and Ingham's Johari window that can be used to identify, organise and abstract potential information needs of these consumers. The conceptual framework illustrates four abstract groups of information needs: recognised demanded, unrecognised demanded, recognised undemanded, and unrecognised undemanded. The paper highlights the potential usefulness of the framework for information providers and systems designers.

Keywords: Consumers, Health information Systems, Information Behaviour, Information Modeling, Information Needs

1. Introduction

Current healthcare systems - especially in developed countries such as the United States and Australia - face key difficulties (e.g. increasing chronic diseases, aging population, rising health costs, shortage of healthcare professionals) [1-2]. The use of information and communication technologies in providing healthcare services to consumers is perceived as an enabling mechanism to help resolve these problems or difficulties [1,3]. The US-based eHealth Initiative [1] and the Health Informatics Society of Australia [3] acknowledge the need for "engaging consumers" as an important way to enhance the healthcare system by using such tools. Consumers in healthcare systems may include patients, informal carers and other members of the general public.

Comprehensive understanding of the information needs of consumers is a basic step before developing effective Health Information Systems (HIS) that target those consumers and that attempt to engage them. It also helps in the evaluation of how well these needs are fulfilled. Moreover, it helps in understanding other dimensions such as consumers' information behaviours and sources. A careful identification, analysis and classification of information needs is therefore an important foundation for the designing and functioning of these systems. It is argued that existing literature tends not to examine the assumptions behind information needs, but rather treat it as obvious that need is based on demand e.g. [4]. Therefore, this paper will examine some of the inherent assumptions behind existing understandings of information needs as well as propose a new framework for examining the health information needs of consumers.

Over the last several years, healthcare organisations have increasingly developed and deployed many HIS that target one group of consumers in particular, namely patients [5]. These systems help patients manage their own health, and they enhance the abilities of other people (e.g. family members) to care for them informally. However, most of these systems have failed to achieve the required level of acceptance [6]. This paper suggests one of the reasons for this lack of success is that developers and providers of these HIS have not adequately investigated the needs of the consum-

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ers, and they have assumed what these needs are without consulting these consumers fully enough [7]. Therefore, it may be important to analyse and identify these information needs as experienced by the consumers themselves to decide what information they need for what purpose and in what time and phase of their condition. This may help make HIS more relevant for consumers and assist in conceptualising how the consumers understand and express their experiences of information needs, when designing HIS that target them.

The analysis and identification of information needs should be flexible and open to include new information needs that may arise or change in future. This in turn emphasizes the importance of predicting these information needs in order to meet the aims of any HIS for the consumers to allow them anticipating their own information needs over time and during different situations. Formalized models and frameworks may provide a guide for understanding the potential information needs of consumers. Marcella, Baxter and Moore [8] have highlighted the shortage of such models and frameworks in general.

Consequently, the aim of this paper is to develop a framework that can capture a comprehensive understanding of information needs of consumers and discuss the potential impact of this framework on HIS development.

This paper seeks to contribute to our knowledge of information science and healthcare by portraying a framework for systematic understanding of consumers' information needs in the healthcare system. Using an information systems perspective and a phenomenological approach, the paper addresses an area that has been largely overlooked in the literature and attempts to provide insights into the first-person point of view of consumers of HIS. Moreover, this framework can be tested in subsequent work. The developed framework may be used for evaluation as well, to help information providers to assess their provision of information and to take actions to improve HIS.

2. Information needs

Limitations in understanding the phenomenon of information needs are common in the literature. This paper argues that generally, researchers have identified many causes that give rise to information needs such as: seeking answers, uncertainty reduction, bridging gaps, solving problems, understanding (making sense), and stress and coping [9]. However, as is evident in the literature and in everyday life, information need is more than that, because sometimes information itself increases the stress and uncertainty of individuals [9]. For example, in some situations, individuals may not demand information even if they need it because they may be afraid of the consequences of this information if they have it. Therefore, understanding the difference between need and demand can assist in better defining and understanding information needs.

2.1. Need and demand

The American Heritage® Dictionary of the English Language [10] identifies many definitions for the term "need". Most of them focus on two major meanings "a condition or situation in which something is required" and "necessity of or obligation to". On the other hand, there are various definitions of the term "demand". Most of them concentrate on two major meanings "to ask for something" and "desire or willingness to" [10] get or do something. In this paper, the term "need" refers to something that is essential to do or to resolve something else depending on the context, and the term "demand" refers to individuals' willingness to get something which in turn may lead them to request that thing.

2.2. Information needs: lack and essential

Scholars have introduced many definitions for information needs. For example; Case [9, p. 5] has defined information needs as "recognition that your knowledge is inadequate to satisfy a goal that you have". Braun, Wiesman et al. [11, p. 247] have defined information needs as "expression of missing information needed to perform a particular task". Information needs are also defined as "a perceived gap between what an individual knows and what he or she wants to know to achieve a certain goal" [12, p. 1013] Nevertheless, Wilson [13] has highlighted the difficulty in defining and understanding information needs. In order to avoid this difficulty, Wilson [13] has suggested that information seeking behavior should be studied instead of information needs because information seeking behaviour is a reflection of information needs.

The difficulty in defining and understanding information needs may have several explanations. First, these previous definitions of information needs concentrate on the recognition and expression of the lack of information. This recognition and expression forms only one part or dimension of information needs: recognised information needs that individuals choose to demand. However, information needs are more comprehensive than this limited view. A useful way to help clarify the comprehensiveness of information needs is to use the iceberg analogy[1]. The idea of iceberg analogy has been used to represent various things or situations that are not visible without paying special attention. For example, Freud has used the iceberg analogy to illustrate the structure of the human mind, calling it "the mental iceberg" [14, p. 138]. Applying the same logic here,

1. The idea for the information needs iceberg came up from a discussion between the authors while writing this paper in order to find a simple way to portray the various dimensions of information needs. During the review process, one of the reviewers suggested to provide a theoretical underpinning explanation of the development of the Iceberg and reminded us that Freud (1859-1939) has used the iceberg analogy to represent the three levels of consciousness, naming it the Mental Iceberg.

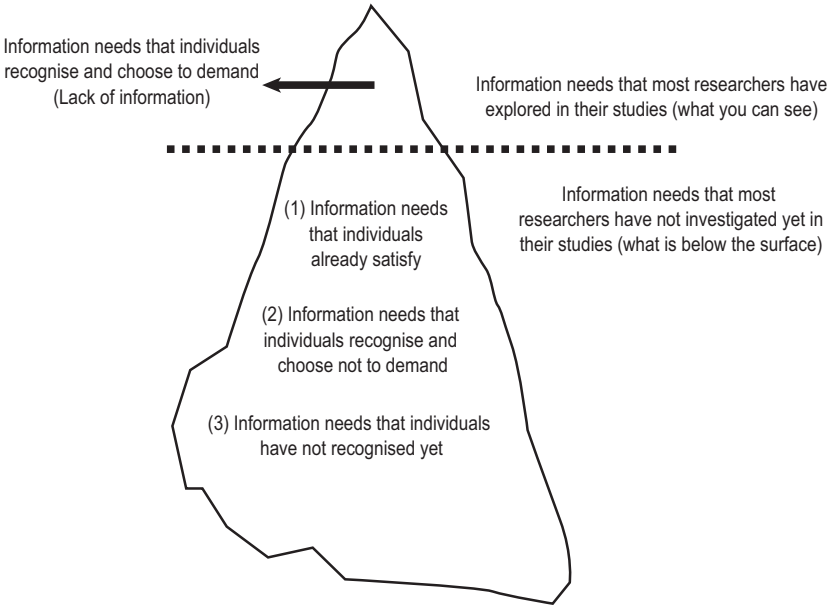

Figure 1: The information needs iceberg (adapted from Sharpe and Ross [14])

the information needs can be compared to an iceberg, wherein only the tip of an iceberg, or the recognition and expression of lack of information, is visible. This includes information needs that individuals recognise and demand. As shown in earlier discussion, current definitions of information needs tend to focus exclusively on this visible surface layer, this forms small part or dimension of information needs. Below the water line or surface are other parts or dimensions of information needs which are not always easily visible. These include information needs that individuals already satisfy, or that they recognise and choose not to demand, or that they have not recognised yet. These parts or dimensions represent the huge size of the iceberg or information needs that are hidden from view. Researchers largely exclude them from their definitions. It is worth noticing that the hidden parts of information needs or iceberg are important as much as the visible part. Therefore, any common definition and understanding of information needs should include these parts or dimensions of information needs in addition to the lack of information.

Second, a key assumption in current literature about information needs is its derivation from the lack-of –information definition. This means that successive studies of information needs fail to include other parts or dimensions of information need, namely those which individuals may not be aware of .Thus, information needs cannot be understood comprehensively from much of the research that has been done, as it does not look at the information needs from this broader perspective.

Third, although studying information seeking behaviour may provide more insight into and lead to better understanding of information needs, studying information seeking behaviour will only allow us to identify and understand one part or dimension of information needs: the recognised and expressed information needs (lack of information) [11]. In other words, it captures the information demand only. However, other parts or dimensions of information needs cannot be captured by studying information seeking behaviour. Therefore, any comprehensive understanding of information needs should be able to identify different patterns of information behaviour that are connected with other dimensions of information needs.

Fourth, in contrast to [13], information seeking behaviour may or may not be a reflection of or stimulated by information needs [12]. In fact, individuals may engage in the information seeking behaviour even if they do not perceive or recognise the need for information. For example, individuals may browse the Internet to get an idea of what information is available that may be of interest to them later. Moreover, they may not perform the information seeking behaviour even if they recognise the need for information because this information may increase their worries [12]. For example, they may ignore information that satisfies their information needs even if they receive it accidentally. This viewpoint has been supported by other scholars. For instance, [15-16] have pointed out that there are other patterns of information behaviour in addition to the information seeking behaviour in response to a situation, giving rise to information needs such as information ignoring and information selecting behaviours. Hence, any comprehensive understanding of information needs should be able to explain the behaviours of individuals in relation to information needs. It should also be able to link various dimensions of information needs with different patterns of information behaviour. For example, it should be able to identify what dimension of information needs influences each pattern of information behaviour, and then these behaviours can be studied further to provide more insights.

Fifth, this paper argues that while recognising that the study of information needs is important to place within the context of the individuals' lives, it is also possible that individuals may not have full cognisance of their "full context". In such a situation individuals may not recognise what they need to know. Therefore, information needs may also be grouped with other human basic needs or considered as the primary essential need of human beings, and not a secondary need as has been proposed by [4], because it gives the individuals information about other human basic needs and

the knowledge of how to satisfy those needs. However, individuals may or may not recognise their information needs and they may or may not demand the fulfilment of these information needs.

In a simple example, the information needs of patients who have to undergo surgery exist whether the patients recognise these needs or not, and whether they demand the fulfillment of these needs or not. Generally speaking, patients need to know information about the 'full context' of the surgery (e.g. purpose of the surgery, consequences of the surgery, percentage of success or failure, recovery and rehabilitation period, nutrition requirements, etc). Patients may in turn find themselves in three positions: They may recognise that they need to know and may demand this information or some of it, because they lack this information or some of it. They may recognise that they need to know this information or some of it but they may not demand it or some of it, either because they already have it or because they fear to have this information or some of it, for whatever reason. They may not recognise that they need to know this information or some of it. Any comprehensive definition and understanding of information needs should be able to reflect these states. The above distinction is also important to make because it looks at health information needs from the point of the consumer of information rather than the provider of that information. Many HIS may capture the knowledge of expert information providers based on their experience of information seekers. However, such an information system design overlooks the life experiences of many individuals who for whatever reason do not present for initial treatment, or are lost to follow-up, or consult but do not take advice, for example.

Accordingly, in questioning existing assumptions, this paper suggests that any comprehensive definition and understanding of information needs should convey the following elements:

1) Information needs exist and present all the time for individuals.
2) Information needs are an essential precursor to individuals' other basic needs.
3) Individuals may or may not recognise their information needs.
4) Individuals may or may not demand that their information needs be met.
5) Individuals may possess information that satisfies their information needs.
6) Individuals may lack information that satisfies their information needs.

Consequently, in this paper, information needs are defined as any form of information that is essential to individuals as a result of the context in which they act. This essential information may be recognised or not recognised and may be demanded or not demanded, and individuals may have it or lack it. This essential information may also take the form of: "advice, opinion, channel of communication and physical entity" [17, Para 13].

In light of the above analysis and framework understanding of information needs comprehensively, we can conclude that information needs differ from merely the recognition and expression of lack of information. More about this difference is discussed in the following sections.

2.3. Information needs: existence and recognition

As stated in section (2.2), defining information needs as the recognition of lack of information is inadequate and slightly misleading, because this recognition of lack of information represents only one part of information needs. Information needs exist and are present all the time even if individuals are not aware of these needs or do not feel a lack of information. For example, information needs of patients who have to undergo surgery exist whether the patients recognise they lack information that satisfies these needs or not and whether they recognise the availability of information that fulfils these needs or not. Various parts of information needs should be acknowledged in order to develop and provide effective information systems that satisfy these needs. These parts of information needs include:

1) Information needs that individuals recognise. These needs may currently be satisfied (possessed information) and/or unsatisfied (lack of information).
2) Information needs that individuals have not recognised yet. These needs might be recognised in future, and then individuals may decide whether these needs are satisfied or unsatisfied at that time.

Hence, information needs differ from either the recognition of lack of information, the recognition of needed information or the recognition of available information. More details about these concepts can be found in Table 1.

Moreover, investigating information needs is more comprehensive than either investigating the recognition of lack of information, the recognition of needed information or the recognition of available information. These are always less comprehensive than information needs for three reasons:

1) Individuals do not recognise all the available information [18-19].
2) Individuals may not recognise all their information needs. For example, a person performs a task, the information that is essential to perform this task exists and may be available, but the person may not recognise what this essential information is or its availability.
3) Lack of information is a consequence of information needs because individuals usually decide and evaluate what information they lack once they become aware of their information needs.

Key Concept	Definition
Information needs	Any information that is essential for individuals as a result of the context in which they act.
Recognition of lack of information	*"A recognition that your knowledge is inadequate to satisfy a goal that you have "* [9, p.5]
Recognition of needed information	The recognition of what this essential information is.
Recognition of available information	The recognition of the availability of information that might fulfils this essential information.

Table 1: Summary of the concepts related to recognition of information

This paper proposes that it is important to study the recognition and non-recognition of needed information, for a more complete picture of the information needs of individuals. This means the information needs may be recognised or not recognised depending on the context of the information needs and the individual circumstances.

2.4. Information needs: existence and demand

It should also be noted that defining information needs as an expression of lack of information is insufficient, because this expression leads individuals to demand information that satisfies this lack by conducting information seeking behaviour (and consequently information searching and retrieving behaviour). This behaviour represents one pattern of information behaviours and captures one part of information needs (those missing needs that consumers usually recognise and seek to meet). Other patterns of information behaviour that are conducted in response to a situation that gives rise to information needs should be acknowledged and linked with their information needs. Hjørland [18] has highlighted the shortage of in-depth analysis and action based on this difference between information needs and information demand. This shortage of analysis also applies to other patterns of information behaviour and their relationship with information needs.

This paper argues that information needs are different from information demand, from the demand for needed information and from demand for available information because information needs exist whether information that fulfils these needs is demanded by individuals or not and made available by information providers or not. More details about these concepts can be found in Table 2.

Moreover, investigating information needs is more comprehensive than investigating information demand, the demand for needed information or the demand for available information. These are always less comprehensive than information needs for four reasons:

1) Individuals do not always demand all the available information or all the needed information (e.g. some types of information may increase their anxiety, which means they may avoid the information even when it is needed).
2) Individuals do not have access to all the available information [18-19] or to all needed information (e.g. if a book contains the needed information but is written in a language they cannot understand).
3) The information provided may be less than the information needed (e.g. information providers usually provide that kind of information which is commonly demanded by individuals but that may not satisfy all needs).

Key Concept	Definition
Information needs	Any information that is essential for individuals as a result of the context in which they act.
Information demand	*"The request made to an information system"* [9, p.67] to satisfy a lack of information.
Demand for needed information	The availability of some characteristics in the information needs context that cause individuals to have the will to get information that fulfils these needs.
Demand for available information	The actual request made by individuals for the available information in an attempt to recognise and/or acquire this essential information.

Table 2: Summary of the concepts related to demand for information

4) Individuals may not accept some forms or types or content of the available information or the needed information (e.g. some individuals do not like to use computers to acquire information).

This paper also proposes that it is important to study the demand or non-demand for needed information, for a more complete picture of the information needs of individuals. This means information needs may be demanded or not demanded depending on the context of the information needs and the individual circumstances.

3. A framework for understanding information needs

To summarise, in section (2.2), we introduce a new definition of information needs that may resolve the problems with previous definitions and support a comprehensive understanding of information needs. This definition acknowledges the existence of information needs and takes account of various parts or dimensions of information needs. For example, parents may or may not recognise that they need information about the illness of their child but this does not eliminate the fact that they need information about this important matter in order to understand and manage the illness responsibly. In the same way, we can apply this example to demand for needed information. The parents themselves may recognise this information need but at the same time they may or may not demand information that meets this information need; they may demand it because it helps them understand the illness of their child or they may not demand it because it may increase their worries. By using these dimensions of information needs, a researcher may capture and identify a more complete picture of information needs including lack of information for any group of consumers. The dimensions of information needs can be summarised as follows:

1) Information needs that are recognised by individuals.
2) Information needs that are not recognised by individuals.
3) Information needs that are demanded by individuals.
4) Information needs that are not demanded by individuals.

Moreover, as individuals who recognise their information needs may subsequently demand or not demand information that fulfils these needs, it is therefore possible to combine the former four dimensions into four abstract groups of information needs in order to understand information needs comprehensively, as stated below:

1) Recognised demanded information needs.
2) Recognised undemanded information needs.
3) Unrecognised demanded information needs.
4) Unrecognised undemanded information needs.

A great way of viewing the above four abstract groups of information needs is to use the "Johari window" [20]. The Johari window is a cognitive psychological tool or framework developed by Joseph Luft and Harrington Ingham in 1955 in the United States as a model for mapping personality awareness and human interaction. In other words, the Johari window is a way of showing how much an individual is aware of his/her personality and how much others are aware of his/her personality. The window contains four areas or panes or quadrants, as shown in Figure 2:

According to this framework, there are characteristics of the individuals' personality that they themselves know about. At the same time, part of the individual's personality is unknown to self. There are also some characteristics of the individuals' personality that others know about and some characteristics unknown to them as well. In terms of what is known and unknown to self and known and unknown to others, it is possible to create four areas that comprise the total window as depicted in Figure 2. Expanding the size of the public area can be made by following two processes: (i) the feedback process, which operates from public to blind areas (individuals ask or receive feedback from others about themselves that is not known by them) and (ii) the disclosure process, which operates from public to private areas (individuals tell others things about themselves that are not known by others). By expanding the public area in both direction (right and down), the size of blind and private areas decreases and there is a possibility to decrease the size of the unknown area as well. This expansion in turn affects the shape of the Johari window.

The Johari window has been used in different contexts such as: human interaction, self-awareness, personal development, improving communica-

	Known to Self	Not Known to Self
Known to Others	Public Area	Blind Area
Not Known to Others	Private Area	Unknown Area

Figure 2: The Johari Window

tions, interpersonal relationships, group dynamics, team development and inter-group relationships [21]. It has also been applied to the study of various aspects of education, information science and communication science, including in healthcare. Moreover, researchers have used Johari window to model interactions between two different groups such as: information professionals and their clients [22], and students and teachers [23]. Other researchers have used it as a way to classify and abstract interactions within one group. For example, Towill and Christopher [24] have used the Johari window as a basis to model the different dimensions of systems architecture.

Regardless of the application of the Johari window, whether between two groups or within one group, it has two functions, the first which depicts or models the different types of personal awareness of individuals. It offers a way to categorise different kinds of things in a given time or life stage. The other function clarifies how to increase the personal awareness of individuals about themselves. It provides a mechanism to move through these categories and become aware of other different types of things.

Consequently, in this paper Johari window is applied to model information needs from one perspective, the individual, and the first function of Johari window is used to depict the four abstract groups of information needs. The other function of Johari window is out of the scope of this paper because it links the information needs to the information behaviours.

As shown in Figure 3, each area contains and represents one group of information needs in terms of whether the information needs are recognised or unrecognised and demanded or undemanded by individuals. At any time or phase, information needs may exist in at least one of four groups: explicit, withheld/avoided, implicit, or ignored group. Although the window shows each group has the same size, it can be altered to reflect the relevant size of each group of information needs in a given situation.

A discussion about each group of information needs is shown below:

1) **The explicit group:** This includes recognised demanded information needs and refers to any form or type of information that is essential to individuals as a result of the context in which they act; both that individuals recognise and that they have the will to get. This group includes information needs that individual are aware of and where the individuals are ready to take actions to obtain information that meets these needs. It is worth mentioning that there are a number of characteristics that help understand why individuals recognise and choose to demand these information needs such as: "stress/coping" [25, p. 682], "self-efficacy" [12, p. 1014, 25, p. 682], "personal factors (socio-demographic, personality traits, skills, self-esteem, a preference for involvement in health-related decision making)", "situational

1) factors (accessibility of information source, trust in information source, individuals' social network)" [12, p. 1014], "time pressure" [16, para 16], "the penalty incurred by acting in the absence of full information", "the availability of information sources", "availability of money" [17, para 17], "complexity" "importance" "frequency" and "predictability" [26, p. 183]. Researchers have called this group "explicit information needs" e.g. [4,11], and "recognised information needs" e.g. [12,27] or used the term "the actual user of information" e.g. [19] for the person who has these types of needs. Most information behaviour research has investigated information needs that fall into this group by studying information seeking behaviour e.g. [4, 28-29]. Designing information systems requires the identification of information needs that fall into this group. Identifying these needs is often easier than identifying those needs that fall into other groups. By studying people's information seeking behaviour and asking them

	Demanded	Undemanded
Recognised	(a) Explicit Group of Information Needs	(b) Withheld/Avoided Group of Information Needs
Unrecognised	(c) Implicit Group of Information Needs	(d) Ignored Group of Information Needs

Figure 3: A general framework of information needs (based on the Johari window)

directly what information do they need and why they choose to demand this information, a researcher can define these needs. A key area for consideration in the design of HIS is smart search interfaces that can assist individuals effectively to find information that fulfils these information needs exactly and rapidly, because individuals are aware of these needs and they choose to satisfy them intentionally.

2) **The withheld/avoided group:** This includes recognised undemanded information needs and refers to any form or type of information that is essential to individuals as a result of the context in which they act; that individuals recognise but they have not the will to act on. This group includes information needs that individuals already satisfy and that are aware of but they have not the desire to fulfil. There are also a number of characteristics that help explain why individuals choose not to demand that these information needs be met, such as: "stress/coping" [25, p. 682], "feelings of guilt", "fear of social stigma regarding certain type of information", "concern that information will contribute to more worry and anxiety" [12, p. 1014], "the involved risk", "unavailability of time", "do not know how to search usefully" [16, para 16], "unavailability of information sources", "unavailability of money" [16, para 16; 17, para 17], "complexity" "importance" "frequency" and "predictability" [26, p. 183]. Researchers have used the term "the potential user of information" e.g. [19] for the person who has these types of needs. Researchers have rarely explored the information needs that fall into this group. Identifying information needs that fall into this group is slightly harder than group (a) or (c). By asking the individuals directly what information they need and why they choose not to demand this information, or asking them to describe a situation where they need information but they choose not to demand information that fulfils these needs, a researcher can identify these needs. A key area for consideration in the design of HIS should include the ability to differentiate between this group and groups (a) and (c). It should also include the ability to identify what will encourage or discourage consumer demand for information. Moreover, it should include the ability to identify when consumers are likely to demand this information, and to offer this information at the appropriate time.

3) **The implicit group:** This includes unrecognised demanded information needs and refers to any form or type of information that is essential to individuals as a result of the context in which they act; that individuals do not recognise but they have the will to get. This pane includes information needs that individuals are not aware of but they have the desire to act on. By taking actions individuals hope to realise what these needs are. Individuals may intentionally become aware of these needs by themselves during the process of seeking for available information, and subsequently they will demand information that fulfils these needs, because they come to have the characteristics that are previously mentioned in (a). Researchers have called this group "implicit information needs" e.g. [4,11], and "unrecognised information needs' e.g. [27] or have used the term "the actual user of information" e.g. [19] for a person with these types of needs. Most information behaviour research has investigated information needs that fall into this pane in the same way as (a), by studying information seeking behaviour. Identifying information needs that fall into this group is slightly harder than group (a) and easier that group (b) because it requires the individuals to explore the information system in order to recognise what information they need, and once these needs are recognised then the individuals will choose to fulfil them. A key area for consideration in the design of HIS is the ability to differentiate between this group and group (a). The HIS should also include a range of ways or techniques to explore different types of information because exploration of information is a critical issue in recognising and subsequently satisfying these information needs. This exploration is also a critical issue in identifying the intervening factors that may motivate or inhibit consumers in recognising their information needs.

4) **The ignored group:** This includes unrecognised undemanded information needs and refers to any form or type of information that is essential to individuals as a result of the context in which they act; that individuals neither recognise nor have the will to act on. Even though individuals may be in a context where it would be possible for them to become aware of these information needs accidentally (e.g. while looking for other information, by listening to other people, or by receiving information from information providers), they do not recognise or demand that these needs be met. These needs also have the characteristics that are previously mentioned in (b). The information needs that fall into this group are yet to be explored systematically. Identifying information needs that fall into this group is likely to be the hardest task, because it requires the individuals to engage in negotiations and conversations with information providers and possibly with other similar individuals in order to recognise what information they need. A researcher can perhaps identify and understand these particular information

needs by asking the individuals who have been through a particular experience to gauge the change in their context between recognising and not recognising the needs, and to identify the triggers that set off the change. If and when these information needs are recognised, then the individuals may be asked: what were the factors that previously stopped their engagement, what factors could engage them, and why they may or may not choose not to demand the recognised information. A key area for consideration in the design of HIS is the ability to differentiate between this group and other three groups (a), (b) and (c). The HIS should also include the ability to identify what will engage or disengage consumers. Moreover, the HIS should include the ability to identify when consumers are likely to recognise and demand information that fulfils these needs.

From this analysis, one can see that undemanded information needs (groups (b) and (d)) have received less attention than they deserve from researchers. Exploring both the recognised undemanded information needs (withhold/avoided group) and the unrecognised undemanded information needs (ignored group) is important for several reasons. First, an information system should be able to anticipate information needs of users whether information that meets these needs is demanded or not. Also, identifying information needs that fall into these two groups helps in portraying a more holistic picture of information needs of consumers.

Second, information providers aim to provide individuals with information that they need and have the desire to get at the required time. Therefore, identifying information needs that fall into these two groups can assist information providers to avoid ineffective approaches to providing individuals with information that they do not have the desire to get. Moreover, overloading individuals with vast amounts of information that they do not have the will to get is likely to be risky, because they may not use this information even if they need it. Furthermore, information overload may increase their anxiety and stress [12], which in turn may influence their tasks and activities adversely.

Third, the characteristics of needed information in these two groups may change over time, as individuals may become aware of and form or lose the will to get information that fulfils these needs. Individuals may move among all four groups at a given time, stage or situation. Their information behaviour will subsequently differ depending on their needs at these points. In addition, users even within a group will have differing views about what information is demanded or not; what is demanded by one individual may not be demanded by another individual, as their circumstances may differ somewhat. Identifying potential information needs may resolve this problem and provide greater likelihood that every individual has the information he/she needs at a particular point of time or as his/her circumstances change.

By identifying and characterising the information needs that fall into each of the four groups, we can explore the relationships and fit between each group and other concepts such as information behaviour, information source and channel, and information design. For example, we can propose that every group of information needs has both its pattern of information behaviour and its type of information sources and channels. We can also propose that every group of information needs has its features of information design. This is a very promising research area, with benefits for information providers and systems designers.

4. Conclusion

Unless potential information needs of any group of end-users have been identified comprehensively, an information system is not likely to be as relevant as possible to them. This paper introduces a new definition of information needs in order to portray a complete picture of information needs. It also shows that investigating information demand instead of information needs explains only a small part of information needs. Other pieces of the picture have been highlighted, such as information needs that are already satisfied, and information needs that people may not demand to have satisfied.

Based on the Johari window, a framework has been developed in this paper for understanding information needs of consumers in general, although the examples we have used show our immediate interest in consumers of health information. This framework is the initial step in further investigations in the field of health information systems. Future research will focus on testing and subsequently validating this framework among one important group of health information consumers: informal carers. It is proposed to extend the framework to explain the various information behaviours that consumers engage in, and the information sources and channels that they choose to seek out, in order to find information to satisfy their information needs. It is intended to elaborate on the framework so that it includes the key design features of information systems that address each distinct group of information needs.

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