


# The role of psychological, skill level and demographic variables in information-seeking behaviours in mental health professionals

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## Abstract

The aim of this study was to identify the variables that can potentially affect information-seeking behaviour in mental health service providers using a quasi-experimental research design. The sample included 30 mental health professionals (with minimum 2 years of experience) to each of whom a scenario was presented in which signs and symptoms of three patients were presented, simulating an actual diagnostic interview. Stress response evaluation (SRE), questionnaires, behavioural observation by the Morae software, and semi-structured interviews were used as means of data collection. Our findings showed that variables such as demographic (e.g. field of study, level of education, work experience and age), psychological (e.g. state and trait anxiety, and therapist's self-assessment) and skill level (e.g. information literacy and expert knowledge) had significant effects on information-seeking behaviour. These results can hopefully provide insights to designers and librarians who seek to create novel or optimise the existing physician-assisted systems.

## Keywords

Expert knowledge; information literacy; information-seeking behaviour; self-evaluation; state and trait anxiety

## 1. Introduction

A significant number of research studies have been undertaken to develop models of information-seeking behaviour in the last few decades, among the most important of which are those proposed by Wilson, Ellis, Kuhlthau, Dervin and Belkin [1]. In the Information Search Process model, Kuhlthau [2] proposes that the information-seeking process consists of three domains, namely, emotional (feelings), cognitive (thoughts) and physical (actions) in the form of six stages, namely, initiation, selection, exploration, formulation, collection and search closure.

Mental health services are absolutely vital social needs, and a reliable diagnosis is an essential component for a proper treatment choice. Recent studies have shown that medical errors are the third leading cause of death in the United States, with annual numbers as high as 251,000 [3]. It is possible to analyse the information-seeking behaviour

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of therapists during the process of diagnosis and treatment based on Kuhlthau's model. According to this framework, therapists receive data from patients in the first stage (Initiation). Next, drawing on their knowledge and expertise, they formulate hypotheses about the potential type of the disease (Selection). In the third stage, therapists search for information to confirm their diagnostic hypothesis, and at this stage, supplementary information such as patient self-reports, medical test results or searches in a database can also be considered by them (Exploration). In case the therapist's initial hypothesis is rejected, a return to the initial stage would happen, and they will begin to gather data and new information from the patient or consult with other specialists or seek information from other resources. At this stage, the initial hypothesis may often be rejected for two main reasons, one being the preliminary data were inadequate and/or the established communication with the patient was not productive. In case the initial diagnosis is confirmed, therapists move on to formulating and finalising their diagnosis (Formulation). Furthermore, by linking the diagnosis with their expert knowledge or using the existing information resources (Collection), if need be, professionals prescribe the appropriate treatment (Search closure).

Recruiting the neuroscientific methodology in different fields has been rapidly increasing in the last few decades. Due to its interdisciplinary nature, research in the field of neuroscience has been inspirational and influential in different fields, and many branches of science such as psychology, artificial intelligence, linguistics and economics have significantly benefitted from a better understanding of the brain and its functions. Using neurophysiological (NP) research methodology, this influence has led to the foundation of several new interdisciplinary fields, including neuroeconomics [4], neuromarketing [5] and neuroinformation system [6]. This research has been designed and implemented to identify the variables that can potentially influence information-seeking behaviour in mental health service providers, during the process of diagnosis, with the hope that the results can be of help in optimising and improving physician-assisted systems.

## 2. Literature review

Many different factors have been emphasised in information-seeking models, and three groups of variables – namely, demographics, psychological and skill level – have been chosen for further investigations in the current research project. The demographic variables included gender, age, the field of study, level of education and background of past treatment. The psychological variables of interest were state and trait anxiety and therapist's self-evaluations, and skill-related variables included information literacy and expert knowledge.

Personal traits, individual skill level, external environment, psychological factors and many other aspects can potentially affect the information-seeking behaviour of users. Ellis et al. [7] believe that each information seeker has their own level of accuracy and focus in each stage of the search process, based on their experiences, needs and expectations [1].

Vakkari [8] holds that age, gender, level of education, occupation and social status, among many other factors, can influence action patterns. Wilson [9] considers self-belief and self-efficacy as one of the most important determining factors in information-seeking behaviours. He believes that a strong self-belief could lead to more extended and accurate use of an information source. Dervin, however, believes that feelings and emotions highly affect the perception of the concept of need, and thus the information-seeking behaviour. His model emphasises the mental efforts of the information seeker in order to fill the information gap in their mind [10]. Kuhlthau [11] considers confusion, doubt, optimism, frustration and level of comfort and satisfaction to be important factors in information-seeking behaviour. In his studies, confusion, level of optimism, frustration, comfort level and satisfaction have been emphasised as the most important components of individual aspects in information seeking.

In this study, the literature on information-seeking behaviour of health professionals have been reviewed and will be presented below, first, considering the processes of information needs and the ways of obtaining this information and second, the variables that potentially affect this behaviour. The point that distinguishes this study from others in the field is the use of tools such as stress response evaluation (SRE) and Morae to evaluate information-seeking behaviour during the diagnostic process.

## 3. Information-seeking behaviour in health professionals

The results of a review of the literature on information needs and information-seeking behaviour in physicians and nurses done by Clarke et al. [12] Show that the most common information need among them is related to the diagnostic process, medicines and choice of treatment. The preferred information source was found to be colleagues; however, the Internet was also reported to be frequently used and considered essential. It was also reported that the effective use of information sources has a significant impact on patient care.

In another study, Demergazzi et al. [13] investigated the information needs and information-seeking behaviour of a group of Italian neurologists. Their results showed that the identification of time- and context-specific needs is required to design effective medical information strategies.

This study took advantage of an innovative tool to collect the questions of the physician in real-time to assess their information needs and searching behaviour while treating patients with multiple sclerosis (MS) and migraine and provides a detailed description of real-life searching behaviour, educational needs and adopted information sources. The information needs of the neurologist and their search behaviour reflect the specific characteristics of the field in which they operate. These findings indicate that identifying the specific time and context needs of physicians is needed to design an effective medical information strategy [13].

In another study, the information-seeking behaviour in medical students and their tutors has been studied [14], aiming at understanding the essential sources of information in this population. Their results showed that information-seeking behaviour was mainly motivated by educational needs and patient care and that the majority of their sample never received any formal education regarding the use of information sources. Colleagues, peers and the Internet were reported to be the most and the literature associated with pharmaceutical companies the least popular sources of information.

#### 4. Factors that affect information-seeking behaviour

Many studies in recent years have investigated the relationship between demographic, psychological, and skill level variables and user information-seeking behaviour. Some of them are reviewed flowing: Hyldegard [15] has shown that the context has a significant impact on physical activities cognitive and emotional experiences regarding information seeking in a research task. Pinto and Sales [16] have carried out a case study on information literacy in users. The result of their study showed that a positive change occurred in a group of student subjects in the first and second cycles regarding the acquisition of information-seeking skills.

Al-Samarraie et al. [17] investigated the influence of the Big Five personality traits on information-seeking behaviour and found that highly conscientious people had the fastest performance, followed by highly agreeable and extroverted participants. These results can be of practical significance for the personalisation of human–computer interfaces.

The research by Lopatovska [18] showed that there was no significant relationship between people's mood before and after seeking information, and no correlation was found between the search topic and difficulty of the task and mood. Krampen et al. [19] studied the research activities and information-seeking behaviours of psychologists based on the Theory of the Intellectual and Social Organization of the Sciences. Their findings showed that demographic psychological variables have a significant impact on information seeking in psychologists.

Wu [20] demonstrated that anxiety had a significant effect on information-seeking behaviour in a way that anxious computer users preferred non-electronic guides because they felt incompetent in using electronic sources. González-ibáñez [21] emphasised the role of emotions in the process of information seeking in users. Furthermore, Savolainen [22] studied the cognitive barriers in information seeking, and his results generally pointed to a negative effect of cognitive barriers on information seeking.

Studies on information-seeking behaviour have increasingly become complex during the past few decades, evolving from cognitive-oriented approaches to emotion-oriented ones. Recently, some studies have also focused on the NP aspects [23], meaning that researchers investigate the neural responses of the brain while the subjects engage in information-seeking behaviours. The research trend in the context of the interactions between human and information and information retrieval have been extensively discussed in different workshops and panels in various conferences during the last years [23–25]. Researchers who are concerned about the limitations of the conventional approach are at the core of this so-called evolution. It is expected that the output of the neuroscientific approach in information science research complements the conventional resources and provides a more reliable cumulative explanation of human behaviour in this area [26]. This provides a deeper understanding that could create great potential for the development of novel models of information seeking [27]. However, the number of interdisciplinary research studies in the areas of information science and neuroscience is still relatively low. Thus, there is a certain need for much more studies that could lead to exciting applied and theoretical results [28].

Information-seeking behaviour incorporates complex emotional and cognitive processes, and thus evokes measurable cognitive, emotional and neural responses [29], including physiologic, such as heart rate and facial expressions, and NP reactions such as brain waves and their frequency. In order to investigate the relationship between psychological and skill level variables with information-seeking behaviour, it is best to evaluate the behaviour in real-time. Fortunately, cognitive neuroscience research tools have enabled researchers to evaluate their behaviour of interest in real-time.

The use of a reliable tool to evaluate user behaviour in real-time can provide relatively more valid insights regarding the behaviour in question [30,31] (and consequently, more reliable data for the purposes of information system design [32]).

Reviewing the literature yields that NP research tools have been applied in numerous research studies in diverse fields such as medicine, neuroscience and cognitive science. This approach has also been recently used to study information-seeking behaviour in the process of information retrieval in users. Since 2010, studies in the area of NeuroIS have been conducted [33], mainly focusing on the effects and use of information technologies [34].

In 2012, Gwizdka proposed NeuroIS as a sub-field aimed at investigating research questions in the area of information science using tools and technologies of the field of cognitive neuroscience [35,36]. Based on this conceptualisation, Moshfeghi and Pollick [27] studied the neuropsychological model of the brain in the context of the need for information. In this research, they took advantage of functional Magnetic Resonance Imaging (fMRI) to observe the activation patterns and connectivity between regions in the brain while performing tasks in two experimental scenarios.

Wu et al. [37] tried to predict search satisfaction using eye movements and physiological signals using geometric analysis. These authors studied the relationship between eye movement and electrodermal activity and searched satisfaction as a cognitive process. In another study, Sarraf [28] investigated Kuhlthau's model of information-seeking behaviour to propose an emotional and neurocognitive map in information retrieval processes. Different aspects such as arousal (comfort, excitement, agitations, etc.) and valence (from extremely negative to extremely positive) in the context of information seeking were considered and their impact on the effectiveness and efficiency of user information seeking was studied.

According to the literature on the subject and the significance of medical treatment and services, this study aimed to investigate the extent to which demographic, psychological and skill level variables affect information-seeking behaviour in the process of diagnosis and treatment and hopefully provide useful insight into the mechanisms of this area of human behaviour. It is hoped that these data will be useful in the development of medical assistance programmes aiming to minimise errors and faults in the process of diagnosis and treatment. Based on the above-mentioned points, this research aimed to provide answers to the following questions:

- Question 1: do demographic variables affect information-seeking behaviour in therapists?
- Question 2: do psychological variables (self-evaluation and state and trait anxiety) affect information-seeking behaviour in therapists in the process of diagnosis and choice of treatment?
- Question 3: is information-seeking behaviour during the process of diagnosis and treatment affected by therapist skills (information literacy and expert knowledge)?

## 5. Methods

To investigate the role of psychological, skill level and demographic variables in information-seeking behaviours in mental health professionals, a total of 30 therapists with at least a master's degree and 2 years of work experience from Atieh Clinical Neuroscience Center (Tehran, Iran) who volunteered to participate in this study were recruited. The experimental procedure is presented in Table 1.

Questionnaires of state and trait anxiety and information literacy were first administered. SRE and Morae tools were used to examine the behaviour of participants during the process of the diagnosis of three experimental scenarios: the first scenario simulated an attention deficit-hyperactivity disorder (ADHD) patient, the second a patient with anxiety disorder, and the third a patient with delirium. PowerPoint slides containing a text were presented to participants, including 49, 32 and 24 symptoms (slides) for the first, second and third simulated patient, respectively.

The presented symptoms were previously assessed and confirmed by three experienced therapists (10–14 years of work experience) to ensure an acceptable order of presentation and validity of the presented symptoms, in addition to categorising the patients in three degrees of difficulty (i.e. easy, moderate and difficult) for the purposes of assessing the expertise of the participants. Finally, this group of experienced therapists was asked to rate the diagnoses provided by the participants on a scale from 0 to 50, based on which it was possible to determine the participant's level of expertise.

All the participants were informed about the experimental procedure before the test and were asked to sign the informed consent form. Participants sat on a comfortable chair in a noise-free room with a sufficient level of light. In the beginning of the experiment, 5 min of resting-state data were collected using the SRE device. Participants then began the diagnostic process by reviewing the PowerPoint slides containing the symptoms on a 14.5-inch screen 70 cm away. Each diagnostic session lasted approximately 180–600 s, with a 60-s break between each session.

**Table 1.** Experimental session workflows.

Session	Procedure	Description	Time
Introduction Questionnaire	Introduction	Informing subjects about the experimental procedure	5 min
	State-Trait Anxiety Inventory (STAI)		7 min
Introduction	Information Literacy		7 min
	Preparation	Placement of SRE sensors and launching Morae software	5 min
Case 1	Data collection	Resting-state SRE data	5 min
	Reviewing the PowerPoint	The diagnostic process by reviewing the PowerPoint slides containing the symptoms	49 slides
	Performance Self-Evaluation Checklist	Questions about the subject's performance in each case	1 min
	Semi-structured Interview	Talking about their emotions while performing the task and the diagnosis	3 min
Case 2	Reviewing the PowerPoint	The diagnostic process by reviewing the PowerPoint slides containing the symptoms	32 slides
	Performance Self-Evaluation Checklist	Questions about the subject's performance in each case	1 min
	Semi-structured Interview	Talking about their emotions while performing the task and the diagnosis	3 min
Case 3	Reviewing the PowerPoint	The diagnostic process by reviewing the PowerPoint slides containing the symptoms	24 slides
	Performance Self-Evaluation Checklist	Questions about their performance in each case	1 min
	Semi-structured Interview	Talking about their emotions while performing the task and the diagnostic	3 min

SRE: stress response evaluation.

## 6. Participants

Thirty therapists from two fields of psychology and psychiatry with at least 2 years of work experience participated in this research. 63.3% of the sample were female, 80% were psychologists and the remaining 20% were psychiatrists. Regarding the educational level, 56.7% had a PhD degree, 23.3% had a master's degree and 20% were specialist physicians. As for age, 40% were below 30 years old, and 33.3% were above 40 years old. Regarding work experience, 36.6% had less than 5 years, and 23.3% had more than 10 years of experience.

## 7. Data collection

After each diagnostic session, participants were asked to explain their emotions while performing the task and the diagnostic steps that they personally followed to identify the stages of Kuhlthau's information searching process. This semi-structured interview was recorded by the Morae software.

After the process of diagnosis and treatment, six general questions regarding their performance were asked from each subject to be rated on a scale of 0 to 10. In order to qualitatively evaluate the data, a scale was defined in which two points were considered for each level, namely, very weak (0–2), weak (2–4), average (4–6), good (6–8) and very good (8–10). Furthermore, a self-evaluation checklist was used to assess the perceived expert knowledge. This was designed by the authors considering three factors, including accuracy of diagnosis (35 points), correct treatment (15 points) and correct differential diagnosis (20 points, in case the diagnosis was not correct). The top three subjects, chosen based on their scores of expert knowledge, were awarded a gift.

The tools used in the research were as follows:

1. The Morae Software: the entire facial reactions of the subjects during the experiment and all the events on the display screen were recorded by the Morae Software that has also been used in other research studies such as by Wu [20] and Zerehsaz [38].
2. Physiological Evaluation of Stress Response: SRE was used for the physiological evaluation of stress. This device measures various electrophysiological indexes of the body, including variations in brain beta waves, respiratory rate, heart rate variability (HRV), temperature and skin conductance. Only the HRV data were included in this study.

3. Performance Self-Evaluation Checklist: this tool was used to assess the evaluations of subjects of their own performance and consists of six questions regarding the difficulty of the process of diagnosis and treatment, expert knowledge about the disorder and the general satisfaction from the proposed treatment. This researcher-made checklist was validated with the help of the supervisor, advisors and three experienced therapists in the field of mental health.
4. The Performance Checklist: this checklist was completed by the researcher and two specialist therapists at the end of the treatment session and not only helped to select the top therapists but also to evaluate their knowledge of the diagnosis and treatment process. This was a researcher-made checklist validated with the help of the supervisor, advisors and three experienced therapists in the field of mental health.
5. State-Trait Anxiety Inventory (STAI): developed by Spielberger in 1970, this inventory consists of 40 questions, 20 for state anxiety and 20 for trait anxiety. The questions are rated on a four-point Likert-type scale, from none to extreme. The validity of this questionnaire has been investigated [30] with a Cronbach's alpha of 0.9.
6. Information Literacy Questionnaire: This questionnaire was designed based on the information literacy standards of the Association of Colleges and Research Libraries (ACRL). Bloom's taxonomy was also utilised to classify information literacy levels. As the main purpose of this study was to identify the knowledge concerning the process of information seeking and its constituents, the advanced level was ignored, and the constituents and dimensions of the two categories of preliminary and basic information literacy skills were considered.

Before further investigation of the variables and the relationships among them, tests of normality were performed, and in the case of non-normality, non-parametric tests were utilised. The Shapiro–Wilk test was used due to the low sample size. The hypotheses dictated the use of the Mann–Whitney, the Analysis of Variance, the Kruskal–Wallis, and the Pearson and Spearman correlation tests.

## 8. Results

Given the purposes of the research, participants were invited to answer the questions about their perception of information-seeking behaviour during the diagnosis and treatment process. The answers to the following main questions of this study will be presented and discussed based on the results.

### 8.1. Question 1: do demographic variables affect information-seeking behaviour in therapists?

The results regarding the effects of the demographic variables (gender, field of study, degree, treatment history and age) will be discussed first, considering its importance in both physical and emotional components of information-seeking behaviour (Table 2).

Investigation of the effect of the demographic variables on information-seeking behaviour (physical and emotional components) showed that gender had no effect. The therapists' field of study was also addressed in this section. The results confirmed that while psychiatrists spent more time in the process of diagnosis at Stage 5 (Collection), psychologists spent more time at Stage 3 (Exploration). Psychiatrists spent almost twice as much time on data collection as psychologists did. The results of the study, along with the results of interviews with the psychiatrists, showed that psychiatrists were more apt to use their mental resources during the diagnosis and treatment process, while psychologists appealed more to reference resources during the treatment and for reaching the final diagnosis.

There was also a significant relationship between the time spent in Stages 3 and 5 (for the second patient) and level of education. Therapists with specialised doctoral degrees spent less time in Stage 3 and more time in Stage 5. In other words, specialist physicians spent less time than others in the early stages (especially the Exploration stage) and devoted their time mostly to the final stages of the diagnosis and treatment process (especially the Collection stage). There was also a significant relationship between the time the therapists spent in Stage 5 (for the second patient) and their work experience (over 10 years). Therapists with more work experience spent more time at Stage 5. As for the last demographic variable, that is, age, the results revealed that there was a significant difference in Stage 5, and for the second patient, meaning that older therapists spent more time in Stage 5. The effect of demographic variables on the level of stress at different stages of Kuhlthau's model was also examined.

Examination of the effect of demographic variables on information-seeking behaviour (stress) showed that gender had no significant effect. However, the effect of the field of study on the level of stress was significant in three stages (Stages 2, 3 and 4) for all three simulated patients. The results showed that psychiatrists were more stressed than psychologists during the whole process of diagnosis and treatment.

**Table 2.** Relationship between demographic variables and the time spent at each stage.

			Elapsed time (seconds)				
			Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Gender	First patient	T or U Test	114.5	71	0.60	79.5	– 0.55
		Sig. (two-tailed)	0.67	0.15	0.55	0.88	0.58
	Second patient	T or U Test	74.5	108.5	0.320	– 1.16	– 1.34
		Sig. (two-tailed)	0.19	0.86	0.75	0.26	0.19
	Third patient	T or U Test	139.5	119	0.648	– 0.74	– 0.33
		Sig. (two-tailed)	0.12	0.53	0.52	0.48	0.74
Field of study	First patient	T or U Test	61.00	67.00	0.725	58.5	– 0.38
		Sig. (two-tailed)	0.59	0.82	0.47	0.93	0.71
	Second patient	T or U Test	67.00	42.5	3.29	– 0.087	– 3.15
		Sig. (two-tailed)	0.79	0.13	0.003	0.93	0.005
	Third patient	T or U Test	81.00	65.5	2.37	1.32	0.601
		Sig. (two-tailed)	0.63	0.74	0.03	0.21	0.56
Degree	First patient	ANOVA or Kruskal–Wallis	61.00	67.00	0.526	58.5	0.145
		Sig. (two-tailed)	0.57	0.79	0.47	0.527	0.70
	Second patient	ANOVA or Kruskal–Wallis	67.00	42.5	10.84	0.008	9.91
		Sig. (two-tailed)	0.79	0.13	0.003	0.93	0.005
	Third patient	ANOVA or Kruskal–Wallis	81.00	65.5	2.44	1.74	0.361
		Sig. (two-tailed)	0.63	0.74	0.13	0.21	0.56
Treatment history	First patient	ANOVA or Kruskal–Wallis	0.251	0.395	0.286	4.10	0.103
		Sig. (two-tailed)	0.88	0.82	0.75	0.13	0.90
	Second patient	ANOVA or Kruskal–Wallis	2.73	1.045	1.11	1.96	3.99
		Sig. (two-tailed)	0.26	0.59	0.34	0.17	0.04
	Third patient	ANOVA or Kruskal–Wallis	1.013	0.292	0.478	0.344	1.71
		Sig. (two-tailed)	0.60	0.86	0.62	0.72	0.23
Age	First patient	ANOVA or Kruskal–Wallis	0.014	0.504	0.274	0.54	0.155
		Sig. (two-tailed)	0.99	0.78	0.76	0.76	0.86
	Second patient	ANOVA or Kruskal–Wallis	4.84	0.582	1.142	1.723	4.834
		Sig. (two-tailed)	0.09	0.75	0.33	0.21	0.02
	Third patient	ANOVA or Kruskal–Wallis	1.45	0.433	0.391	2.31	0.181
		Sig. (two-tailed)	0.48	0.81	0.68	0.15	0.84

ANOVA: analysis of variance.

Furthermore, the results revealed a direct relationship between the level of education and stress during the process of diagnosis and treatment selection. In most cases, the Psychiatrists were more stressed at different stages than other therapists. Also, therapists with more years of experience were more stressed and emotional during the process. As for the effect of age on stress and emotions, it was found that in most cases, older therapists were more stressed.

## 8.2. Question 2: do psychological variables (self-evaluation and state and trait anxiety) affect information-seeking behaviour in therapists in the process of diagnosis and choice of treatment?

Psychological factors are often discussed in the majority of models of information-seeking behaviour [7,9–11]. However, cognitive factors include the components that are connected with the seeker's personality traits, cognitive processes and intrinsic characteristics while dealing with information. State and trait anxiety plus therapist self-evaluation (self-confidence) was the psychological variables that were examined in this study. Table 3 represents the results of the Pearson and Spearman correlation (considering the precondition of the normality of data distribution) between therapists' psychological variables and the time they spent in different stages of Kuhlthau's model.

Based on the results presented in Table 3, a significant inverse relationship was observed between state anxiety and the time the therapists spent in Stage 2 for the third patient ( $r = -0.42, p < 0.05$ ) and Stage 3 for the second patient ( $r = -0.37, p < 0.05$ ). In other words, therapists with less anxiety spent more time at these two stages. Furthermore, a significant positive relationship was observed between trait anxiety and the time the therapists spent in Stage 4 for the second patient ( $r = -0.46, p < 0.05$ ), meaning that therapists with more trait anxiety spent more time at Stage 4 for

**Table 3.** Relationship between demographic variables and the level of stress at each stage of Kuhlthau's model.

			Stress (HRV)					
			Baseline	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Gender	First patient	Tor U Test	− 1.04	0.796	− 0.286	0.006	− 0.0377	− 0.026
		Sig. (two-tailed)	0.31	0.43	0.78	0.99	0.71	0.98
	Second patient	Tor U Test	− 1.04	0.270	− 1.33	0.483	0.066	− 1.23
		Sig. (two-tailed)	0.31	0.79	0.19	0.63	0.95	0.23
	Third patient	Tor U Test	− 1.04	− 0.473	− 0.844	− 1.23	0.761	− 0.281
		Sig. (two-tailed)	0.31	0.64	0.40	0.23	0.45	0.78
Field of study	First patient	Tor U Test	− 1.19	− 0.287	− 0.684	− 0.691	− 0.828	− 1.41
		Sig. (two-tailed)	0.24	0.78	0.52	0.56	0.44	0.38
	Second patient	Tor U Test	− 1.19	− 1.49	− 2.26	− 1.54	− 2.15	1.40
		Sig. (two-tailed)	0.24	0.15	0.03	0.14	0.049	0.17
	Third patient	Tor U Test	− 1.19	− 1.55	− 1.92	− 2.56	− 1.73	− 1.86
		Sig. (two-tailed)	0.24	0.13	0.06	0.02	0.10	0.08
Degree	First patient	ANOVA or Kruskal–Wallis	1.294	0.730	2.694	2.53	2.279	3.61
		Sig. (two-tailed)	0.29	0.49	0.09	0.10	0.12	0.04
	Second patient	ANOVA or Kruskal–Wallis	1.294	1.07	4.41	2.84	4.98	3.69
		Sig. (two-tailed)	0.29	0.36	0.02	0.07	0.01	0.04
	Third patient	ANOVA or Kruskal–Wallis	1.294	1.317	2.434	3.89	1.88	3.09
		Sig. (two-tailed)	0.29	0.28	0.11	0.03	0.17	0.07
Treatment history	First patient	ANOVA or Kruskal–Wallis	4.64	1.056	3.01	2.05	3.24	3.08
		Sig. (two-tailed)	0.02	0.37	0.07	0.15	0.06	0.06
	Second patient	ANOVA or Kruskal–Wallis	4.64	2.05	5.58	3.66	1.92	2.95
		Sig. (two-tailed)	0.02	0.15	0.01	0.04	0.17	0.07
	Third patient	ANOVA or Kruskal–Wallis	4.64	3.62	3.08	7.09	2.24	1.69
		Sig. (two-tailed)	0.02	0.038	0.063	0.003	0.13	0.21
Age	First patient	ANOVA or Kruskal–Wallis	3.44	1.23	1.83	1.55	2.63	3.60
		Sig. (two-tailed)	0.047	0.31	0.18	0.23	0.09	0.04
	Second patient	ANOVA or Kruskal–Wallis	3.44	2.46	5.57	4.60	3.06	4.33
		Sig. (two-tailed)	0.047	0.10	0.01	0.02	0.06	0.03
	Third patient	ANOVA or Kruskal–Wallis	3.44	5.23	3.63	4.78	3.40	4.94
		Sig. (two-tailed)	0.047	0.01	0.04	0.02	0.049	0.02

HRV: heart rate variability; ANOVA: analysis of variance.

the second patient. Also, there was a significant and positive correlation between the therapists' attitudes towards their performance and the time they spent at Stage 4 for the second patient ( $r = 0.697$ ,  $p < 0.001$ ). This relationship indicated that the better the therapist's attitude was towards their performance, the more time they spent at Stage 4. For a closer examination, it is advisable to replicate this research with a larger statistical population. Table 4 presents the relationships between psychological variables before the start of and during the process of diagnosis and treatment (information-seeking behaviour).

Exploring the relationships between the level of stress (information-seeking behaviour) and psychological variables demonstrated that there was a significant and inverse relationship between state anxiety and stress level in Stage 1 ( $r = -0.382$ ,  $p < 0.05$ ) and Stage 3 ( $r = -0.364$ ,  $p < 0.05$ ) for the first patient. In other words, therapists with a higher level of initial anxiety were significantly less stressed in these two stages. The results also showed that there was a significant and positive relationship between the stress level and the attitude towards one's own performance in Stage 2 ( $r = -0.39$ ,  $p < 0.05$ ) and Stage 4 ( $r = -0.38$ ,  $p < 0.05$ ) for the second patient. For a closer examination, it is recommended that this research be replicated with a larger statistical population.

### 8.3. Question 3: is information-seeking behaviour during the process of diagnosis and treatment affected by therapist skills (information literacy and expert knowledge)?

Skill-based capabilities can influence information-seeking behaviour [8,9,16] during the diagnosis and treatment process. The therapists' skill-based capabilities originate from their prior knowledge. Prior knowledge refers to the knowledge or skill-based capabilities that individuals exploit in situations when they need it to tackle problems or perform tasks [20].



**Table 4.** Relationships between the psychological variables and the time spent at each stage (information-seeking behaviour).

			Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
State anxiety	First patient	Correlation	− 0.18	− 0.11	− 0.15	0.03	0.23
		Significant	0.35	0.56	0.42	0.88	0.28
	Second patient	Correlation	− 0.28	− 0.06	− 0.37	0.19	0.29
		Significant	0.13	0.77	0.04	0.14	0.21
	Third patient	Correlation	− 0.06	− 0.42	− 0.12	− 0.14	0.19
		Significant	0.77	0.02	0.54	0.65	0.53
Trait anxiety	First patient	Correlation	− 0.09	− 0.18	0.01	0.09	0.07
		Significant	0.63	0.36	0.94	0.65	0.73
	Second patient	Correlation	− 0.28	0.04	0.15	0.46	0.14
		Significant	0.14	0.84	0.43	0.04	0.54
	Third patient	Correlation	− 0.31	− 0.23	0.04	0.03	0.33
		Significant	0.10	0.23	0.82	0.93	0.25
Self-evaluation	First patient	Correlation	− 0.01	− 0.02	− 0.23	− 0.12	− 0.04
		Significant	0.95	0.92	0.21	0.57	0.86
	Second patient	Correlation	0.28	0.32	0.01	0.70	0.30
		Significant	0.14	0.09	0.95	0.00	0.20
	Third patient	Correlation	0.10	0.20	0.27	0.38	− 0.30
		Significant	0.59	0.28	0.15	0.20	0.30

**Table 5.** Relationships between the psychological variables and level of stress (HRV).

			Baseline	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
State anxiety	First patient	Correlation	− 0.20	− 0.38	0.34	− 0.36	− 0.35	− 0.30
		Significant	0.29	0.04	0.09	0.05	0.63	0.13
	Second patient	Correlation	− 0.20	− 0.21	− 0.18	− 0.27	− 0.29	− 0.16
		Significant	0.29	0.27	0.34	0.14	0.12	0.47
	Third patient	Correlation	− 0.20	0.07	− 0.18	− 0.13	− 0.23	0.17
		Significant	0.29	0.72	0.35	0.49	0.24	0.49
Trait anxiety	First patient	Correlation	− 0.08	− 0.09	− 0.05	− 0.05	− 0.06	− 0.01
		Significant	0.69	0.62	0.79	0.81	0.75	0.95
	Second patient	Correlation	0.08	− 0.16	− 0.10	− 0.07	− 0.05	− 0.11
		Significant	0.69	0.40	0.59	0.72	0.79	0.60
	Third patient	Correlation	− 0.08	0.07	− 0.09	− 0.10	− 0.01	0.23
		Significant	0.69	0.73	0.69	0.61	0.94	0.37
Self-evaluation	First patient	Correlation	0.20	0.12	0.01	0.08	0.13	0.19
		Significant	0.29	0.53	0.96	0.69	0.51	0.34
	Second patient	Correlation	0.26	0.29	0.39	0.27	0.38	0.27
		Significant	0.17	0.12	0.03	0.14	0.04	0.20
	Third patient	Correlation	0.34	0.34	0.29	0.26	0.13	0.39
		Significant	0.06	0.07	0.12	0.17	0.51	0.10

Information literacy (preliminary and basic) and specialised knowledge were evaluated as two such skills in this study. Table 5 represents the results of the Pearson and Spearman correlation test (considering the precondition of normality in the data distribution), calculating the correlation between skill-based capabilities and the time spent at various stages of Kuhlthau's model.

Based on the results, there was a significant inverse relationship between information literacy and the time the therapists spent in the process of information seeking (for the second patient) in Stages 1 and 3. In other words, therapists with fewer preliminary skills in information literacy were more apt to pause at these two stages. As for the time the therapists spent at Stage 5 (for the first patient), a positive relationship with information literacy was observed, meaning that therapists with better basic information literacy skills spent more time at Stage 5. There was also a positive and significant correlation between expert knowledge and the time the therapists spent at Stage 4 for the second patient ( $r = 0.60$ ,  $p$

**Table 6.** Relationships between skill-based capabilities and the time spent during each stage of Kuhlthau's model (information-seeking behaviour).

			Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Information literacy (preliminary)	First patient	Correlation	− 0.19	− 0.024	− 0.11	0.02	0.30
		Significant	0.31	0.49	0.57	0.93	0.15
	Second patient	Correlation	− 0.37	− 0.11	− 0.39	0.26	0.16
		Significant	0.04	0.57	0.03	0.26	0.49
	Third patient	Correlation	− 0.23	− 0.09	− 0.23	0.19	0.33
		Significant	0.23	0.63	0.21	0.54	0.25
Information literacy (basic)	First patient	Correlation	− 0.10	− 0.05	− 0.07	0.01	0.45
		Significant	0.59	0.80	0.73	0.96	0.03
	Second patient	Correlation	− 0.09	− 0.05	− 0.26	− 0.18	0.05
		Significant	0.64	0.79	0.17	0.44	0.83
	Third patient	Correlation	− 0.04	− 0.08	− 0.02	0.04	0.17
		Significant	0.83	0.68	0.91	0.90	0.57
Specialised knowledge	First patient	Correlation	− 0.01	− 0.02	− 0.20	− 0.12	− 0.01
		Significant	0.95	0.92	0.28	0.57	0.99
	Second patient	Correlation	0.28	0.32	0.03	0.60	0.33
		Significant	0.14	0.09	0.89	0.01	0.15
	Third patient	Correlation	0.01	0.20	0.18	0.31	0.24
		Significant	0.59	0.28	0.33	0.30	0.41

**Table 7.** Relationships between the skills and stress during each state of Kuhlthau's model.

			Baseline	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
State anxiety	First patient	Correlation	− 0.03	− 0.12	0.10	0.14	0.05	0.10
		Significant	0.89	0.52	0.61	0.47	0.81	0.61
	Second patient	Correlation	− 0.03	− 0.19	− 0.10	0.04	0.29	0.15
		Significant	0.89	0.32	0.58	0.84	0.12	0.48
	Third patient	Correlation	− 0.03	− 0.07	− 0.05	0.03	0.11	0.51
		Significant	0.89	0.71	0.79	0.86	0.59	0.02
Trait anxiety	First patient	Correlation	− 0.10	0.26	− 0.04	− 0.04	− 0.16	− 0.09
		Significant	0.60	0.17	0.81	0.82	0.40	0.67
	Second patient	Correlation	− 0.10	− 0.35	0.07	− 0.13	0.15	0.01
		Significant	0.60	0.06	0.69	0.48	0.42	0.96
	Third patient	Correlation	− 0.10	− 0.11	− 0.14	− 0.16	− 0.14	0.44
		Significant	0.60	0.56	0.46	0.40	0.49	0.06
Self-evaluation	First patient	Correlation	0.05	0.23	0.15	0.21	0.25	0.30
		Significant	0.78	0.22	0.42	0.28	0.19	0.12
	Second patient	Correlation	0.13	0.07	0.17	0.08	0.41	0.17
		Significant	0.50	0.71	0.37	0.66	0.02	0.44
	Third patient	Correlation	0.10	0.10	0.10	0.08	0.38	0.27
		Significant	0.62	0.62	0.59	0.66	0.04	0.27

< 0.01). This relationship indicated that therapists with more specialised knowledge spent more time at this stage. The results regarding the relationship between the skills and level of stress during the process of diagnosis and treatment (information-seeking behaviour) are presented in Table 6.

According to the results, no significant relationship was observed between information literacy and level of stress in their information-seeking process except at Stage 5 for the third patient. The results showed that at this stage (Stage 5 for the third patient), therapists with higher information literacy (preliminary skills) exhibited more HRV (stress). The results also revealed that there was a direct and significant relationship between the stress and expert knowledge at Stage 4 for the second ( $r = -0.41, p < 0.05$ ) and for the third patient ( $r = -0.38, p < 0.05$ ). In other words, therapists with more expert knowledge experienced more stress at this stage Table 7.

## 9. Discussion

Although the use of physiological and neurobiological metrics has not previously been common in information-seeking investigations [39], with the advances in assessment tools in the area of neuroscience, new research lines in the study of information-seeking behaviour have been introduced [40].

A deep understanding of information-seeking behaviour is currently the main challenge in information science because such an insight can significantly improve the services offered to users and the design of efficient information systems [24,26,28,41,42]. Although this study has been conducted on a small sample of therapists and has some limitations such as non-homogeneity of the data (the demographic, psychological and skill level data have a limited range and the time it took subjects to complete tasks and the HRV data have a high level of variance) could make it harder to find significant correlations, our results turned out to be promising and might be of use in the design of decision support systems; thus, it is suggested that the remaining issues be further investigated in future research studies.

The effect of demographic variables (except gender) on the information-seeking behaviour (emotional and physical components) was found to be significant. These variables were most visible in physical reactions (the time spent) in the later stages of Kuhlthau's model and in the second experimental patient. However, the effect of the demographic variables on the stress level was observable in the majority of stages in Kuhlthau's model in all the three simulated patients. The significant effect of demographic variables on information-seeking behaviour has also been previously shown [19,43,44], based on which the idea of personalised assisting systems according to the demographics of each therapist seems fairly essential.

The relationship between psychological variables (anxiety and self-efficacy) and information-seeking behaviour (emotional and physical components) was also investigated. The results showed a negative correlation between state and trait anxiety and the time spent in the early stages (1 to 3) of Kuhlthau's model. The impact of anxiety on information-seeking behaviour has been investigated by Wu [20] and Birks [45], which our results confirm.

The results also showed that there is a positive correlation between self-evaluations of performance and the time spent in the diagnosis and treatment process. In other words, the more time a therapist spent on any of the stages of Kuhlthau, the more positive they evaluated themselves. Another positive relationship was found between self-evaluations and the level of stress. This correlation means that, on average, the better subjects evaluated themselves, the more stress (defined by HRV) they experienced during the process of diagnosis and treatment. This stress is not necessarily a negative player since it can lead to better performance in therapists. Similar relationships have been observed in various other research projects [46–50].

In this research, significant relationships were observed between skill level variables (information literacy and expert knowledge) and the information-seeking behaviour (emotional and physical components). The results showed that higher levels of information literacy negatively correlated with the time spent on the early stages of Kuhlthau's model, meaning that therapists with higher levels of information literacy spent more time on higher levels of the model rather than the first stages. This finding can be of use in the design of decision support systems to improve the accuracy of diagnosis and treatment. In this regard, the findings of the current study, which is in line with that of previous research studies [16,43], will hopefully contribute to the literature meaningfully. Furthermore, based on the results of the current and other similar studies, the necessity for educating therapists on information literacy seems non-negligible.

The results also showed that there is a significant positive correlation between expert knowledge and time spent by the therapists on different stages of Kuhlthau. Something of interest here was a negative correlation between this time and the expert knowledge level while visiting the first experimental patient. In other words, therapists with higher levels of expert knowledge (in the simple patient scenario) spent less time in different stages of the model. This correlation turned to a negative relationship in the second and third patients, meaning that therapists with higher levels of expert knowledge spent more time in different stages of the model. Furthermore, a significant positive relationship was observed between stress level and expert knowledge, meaning that therapists with higher levels of expert knowledge exhibited more stress in different stages of Kuhlthau's model.

Altogether, the findings regarding the psychological capabilities and the skill level showed that therapists require a certain level of previous knowledge and skill level to successfully perform the act of gaining information and engaging in the process of diagnosis and treatment. Previous research studies have also shown that people with this knowledge base and skill set are significantly more successful in the process of information seeking [16,20]. The skill sets and the knowledge base also play a key role in increasing useful and positive stress and emotions in the process of information seeking [8,9,16,20]. Thus, it seems that considering demographics, psychological and skill level variables can be a fruitful avenue to facilitate and improve the information-seeking behaviour in therapists.

## 10. Conclusion

This study examined the variables that can affect a therapist's information-seeking behaviour while diagnosing psychological disorders using SRE and Morae software. Results of the SRE (heart rate) analysis showed that some of the studied variables such as the amount of time spent in different stages of Kuhlthau's model and the level of their instantaneous stress affect the information-seeking behaviour implying that they can be considered in the design of physician-assisted systems to increase the efficiency and accuracy of diagnosis.

As far as the authors are informed, this is the first study of its kind that aimed to examine the information-seeking behaviour of therapists at the time and during the diagnosis and treatment process. This investigation can hopefully enrich the literature in the field of information-seeking behaviour of therapists and be of help in designing physician assistant software. This study shows that some demographic variables can affect information-seeking behaviour. Furthermore, it shows that psychological and skill factors should be considered when studying information behaviour. Our findings show the importance of interdisciplinary collaborations and the relationship between information science theories and models and experimental cognitive psychology and behavioural sciences.

However, there are still limitations that need to be addressed. For example, this study was limited to a small sample of therapists in a specific clinic, which may influence the reliability and ecological validity of the results. Therefore, other studies on larger samples, in real-world conditions with real patients, along with considering the influence of cognitive variables on information-seeking behaviour, can be informative and insightful for this line of research.

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