Psychological characteristics and behaviors on the internet as risk factors for the development of fear of childbirth in pregnant women

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PSIHOLOŠKE KARAKTERISTIKE I PONAŠANJA NA INTERNETU KAO RIZIČNI ČIMBENICI ZA RAZVOJ STRAHA OD PORODA U TRUDNICA

DOKTORSKI RAD

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Nositeljica više kolegija iz područja kliničke psihologije na svim razinama studija psihologije na matičnom fakultetu. Suradnica je na nekoliko kolegija na diplomskoj i poslijediplomskom studiju medicine. Mentorica je diplomskim, specijalističkim i doktorskim radnjama. Voditeljica je Poslijediplomskog specijalističkog studija kliničke psihologije. Aktivno se bavi istraživačkim radom. Znanstveni je interes otpočetka karijere vrlo aktivno usmjerila prema istraživanju etioloških čimbenika anksioznosti, pojavnih oblika anksioznih poremećaja i njihovom liječenju, kao i prema psihičkim manifestacijama stresa. Osim navedenog, klinički i istraživački se bavi fenomenom transpolnosti. Bila je voditeljica nekoliko znanstvenih projekata. Objavila brojne znanstvene i stručne radove u domaćim i inozemnim časopisima. Autorica više poglavlja u knjigama i udžbenicima. Licencirani je kognitivno-biheviorални terapeut. Dobitnica je više nagrada Hrvatske psihološke komore i Hrvatskog psihološkog društva. Predsjednica je međunarodnog udruženja za istraživanje stresa, traume, anksioznosti i otpornosti (The Stress, Trauma, Anxiety, and Resilience Society - STAR Society). Predsjednica je udruge kako si? na što je posebno ponosna.

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Abstract

Pregnancy is a unique time in a woman's life characterized by various physical, social, and psychological transformations. Women often rely on the internet to find information to cope with these changes. The purpose of this doctoral thesis was to investigate how the internet affects the development and management of psychological difficulties during pregnancy, particularly the phenomenon of “cyberchondria”. Cyberchondria refers to the excessive and repetitive online search for health information, which results in heightened anxiety. To address this issue, a range of research designs were used. First, a review of existing literature was conducted, focusing on the patterns and motivations of pregnant women's use of the internet for health-related information. Demographic, obstetric, and psychological variables linked to online health research were also explored. Next, a correlational study was conducted with 360 participants, examining cyberchondria predictors in women with and without pregnancy complications. Health anxiety and pregnancy-specific anxiety were identified as predictors of cyberchondria, with distinct roles depending on complications. Finally, a longitudinal study was conducted with 149 participants, examining the risk factors, triggers, and outcomes of cyberchondria among pregnant women. The study found that health anxiety and the cognitive aspect of anxiety sensitivity were risk factors, while pregnancy concerns related to motherhood were triggers for cyberchondria. While an association between cyberchondria and fear of birth was noted, fear of birth did not manifest as a direct outcome of cyberchondria. Collectively, the results of these studies highlight the importance of understanding the relationship between online health information, cyberchondria, and anxiety for pregnant women.

Keywords: internet, online health research, cyberchondria, anxiety, health anxiety, pregnancy-specific anxiety, anxiety sensitivity, fear of birth, pregnancy, pregnancy complications

Proširenisažetak

Uvod

Internet je u današnje vrijeme učestao medij putem kojeg osobe prikupljaju informacije o zdravlju. Žene češće koriste internet kako bi došle do zdravstvenih informacija, a njihova sklonost pretraživanju intenzivira se tijekom trudnoće koja je za njih vrlo važno životno razdoblje. Trudnoća je složeno razdoblje koje kod brojnih žena dovodi do anksioznosti i brige o zdravlju. Kao način nošenja s tjeskobom, velik broj trudnica informacije o zdravlju traži na Internetu. Kad se upuštaju u pretjerano, kompulzivno i ponavljajuće istraživanje o zdravlju koje je praćeno povećanom anksioznošću, dolazi do razvoja kiberohondrije.

Cilj ovog doktorskog rada bio je istražiti ulogu interneta, kao informacijskog okoliša, u razvoju i održavanju psihičkih teškoća kod trudnica. Poseban je fokus usmjeren na kiberohondriju kao konstrukt koji nije ranije proučavan kod trudnica. Dok je zdravlje majki u digitalno doba postalo predmet sve većeg interesa, odnosi između online pretraživanja informacija, kiberohondrije, anksioznosti i straha od poroda do sada nisu bili sveobuhvatno proučavani. Kako bi se odgovorilo na istraživačka pitanja, području se pristupilo koristeći kombinaciju istraživačkih pristupa, koji obuhvaćaju sveobuhvatan pregled literature (1. dio), korelacijsko (2. dio) i longitudinalno istraživanje (3. dio).

1. dio

U prvom dijelu doktorske disertacije, koji je u formi preglednog rada, sažeti su nalazi o fenomenu pretraživanja zdravstvenih informacija na internetu kod trudnica. Predstavljeni su podaci o raširenosti i učestalosti korištenja interneta tijekom trudnoće. Detaljno su opisani facilitirajući i inhibirajući faktori zbog kojih se trudnice upuštaju u pretraživanje informacija o zdravlju, kao i procesi u zdravstvenom sustavu koji ih navode na pretraživanje. Kao vrlo česti razlozi koje trudnice navode su brzina i jednostavnost dolaženja do informacija, fleksibilnost, privatnost, velika količina informacija na internetu, jednostavna terminologija i informacije do kojih se može doći besplatno. Prikazani su najčešće korišteni internetski izvori zdravstvenih informacija i teme o kojima trudnice najviše pretražuju. Većina žena do informacija dolazi tako da koriste tražilicu na internetu, dok manji broj posjećuje specifične stranice koje su im dobro poznate. Kao tema o kojoj se najviše pretražuje pokazuje se razvoj fetusa. Druge važne teme su i dijagnostika i testiranja u trudnoći, komplikacije, fiziologija i

stadiji trudnoće i poroda, promjene u trudnoći, životni stil trudnica, informacije o liječnicima, partnerski odnosi te psihološka pomoć za trudnice. Objašnjeni su aspekti pouzdanosti informacija namijenjenih trudnicama na internetu, kao i faktori koje one uzimaju u obzir prigodom procjene točnosti i relevantnosti informacija. Navedeni su nalazi oko diskutiranja o informacijama koje trudnice pronađu na internetu sa stručnjacima koji vode brigu o njihovoj trudnoći. Dio trudnica navodi da su tijekom trudnoće htjele dobiti više informacija o tome kako da kvalitetno brinu o sebi i djetetu nakon poroda - htjele su dobiti više informacija koje su usmjerene na jačanje njihovih kompetencija kao novih roditelja, a ne samo one usmjerene na djecu. Dan je sažet pregled demografskih, opstetričkih i psiholoških karakteristika trudnica zbog kojih su one sklonije pretraživanju informacija o zdravlju. Opstetričke informacije koje su do sad istraživane su paritet, tromjesečje i komplikacije u prethodnoj i trenutnoj trudnoći. Psihološke karakteristike koje su opisane su zdravstvena pismenost, samoefikasnost, zdravstveni lokus kontrole, zdravstvena anksioznost i anksioznost specifična za trudnoću. Objašnjeni su efekti i posljedice koje internetsko pretraživanje ima na funkcioniranje i dobrobit trudnica s naglaskom na kompulzivno pretraživanje i intenziviranje anksioznosti nakon pretraživanja. Na kraju rada je opisana važnost daljnjih istraživanja u području s obzirom na brojne praktične implikacije. Naglasak je stavljen na nužnost istraživanja ponašanja trudnica na internetu i efekte koje internet ima na njihovo zdravlje i dobrobit, kao i mehanizme u podlozi pretraživanja interneta koji dovode do anksioznosti kod trudnica.

2. dio

U okviru drugog dijela disertacije, provedeno je istraživanje čiji je cilj bio ispitati prediktore kiberohondrije kod trudnica. Za potrebe istraživanja napravljen je online upitnik koji je obuhvaćao socio-demografska i opstetrička pitanja, pitanja o korištenju interneta, *Kratki inventar zdravstvene anksioznosti*, *Ljestvicu zabrinutosti u trudnoći* i *Kratku skalu kiberohondrije*. U istraživanju je sudjelovalo 360 sudionica, prosječne dobi 30 godina (*SD* = 4.8). Sudionice su prosječno bile u 28. tjednu trudnoće (*SD* = 9.4). Polovini sudionica je ovo bila prva trudnoća, i većina njih, točnije *n* = 251 nije imalo komplikacije u trudnoći. Dobiveni rezultati pokazali su da trudnice koje imaju komplikacije u trenutnoj trudnoći imaju i višu razinu zdravstvene anksioznosti, anksioznosti specifične za trudnoću i kiberohondrije u odnosu na one koje nemaju komplikacije u trudnoći. Hijerarhijskom regresijskom analizom utvrđeno je da su zdravstvena anksioznost i anksioznost specifična za trudnoću prediktori kiberohondrije kod trudnica. Pritom anksioznost specifična za trudnoću predviđa kiberohondriju povrh zdravstvene anksioznosti. Zanimljiva je razlika dobivena između

trudnica s urednom trudnoćom i onih koje imaju komplikacije u trudnoći. Kod trudnica koje nemaju komplikacije prediktori kiberohondrije bili su zdravstvena anksioznost i anksioznost specifična za trudnoću, a kod onih koje imaju komplikacije u trudnoći prediktorom kiberohondrije se pokazala samo anksioznost specifična za trudnoću. Nalazi istraživanja pokazuju kako trudnoća za neke žene predstavlja razdoblje života u kojem se može javiti anksioznost, pogotovo ako imaju komplikacije u trudnoći. Trudnice koje dožive komplikacije u trudnoći vrlo su usredotočene na zdravlje djeteta i vlastito zdravlje, stoga često informacije o zdravlju traže na internetu. Prema modelu kiberohondrije, nekim ženama može biti teško prestati s traženjem novih zdravstvenih informacija na internetu, osjećaju se tjeskobno nakon završetka pretraživanja i kreću u novi krug pretraživanja te tako može doći do razvoja kiberohondrije. Prema modelima traženja informacija, žene koje imaju komplikacije u trudnoći također imaju i veću potrebu za informacijama usmjerenim na komplikacije i izraženiju percepciju zdravstvenih rizika. Njihova zabrinutost za zdravlje može se očitovati kroz brige koje su više vezane uz trudnoću tijekom online pretraživanja. Zaključno, žene koje imaju komplikacije u trudnoći imaju i veće šanse za razvoj kiberohondrije.

3. dio

Prema kognitivno-bihevioralnim modelima kiberohondrije, postoje stabilni rizični čimbenici za razvoj kiberohondrije. Osim o osobinama, online pretraživanje ovisi i o trenutnim zdravstvenim okolnostima, odnosno okidačima koji dovode do pretjeranog i kompulzivnog online pretraživanja i njegovih negativnih posljedica. Cilj ovog dijela disertacije bio je ispitati čimbenike rizika, okidače i ishode kiberohondrije u trudnica. Za potrebe ovog longitudinalnog istraživanja napravljen je online upitnik koji je ispunilo 149 sudionica u tri točke mjerenja - u ranoj trudnoći (14.-19. tjedan), sredinom trudnoće (24.-29. tjedan) i u kasnoj trudnoći (34.-39. tjedan). Dobiveni rezultati ukazuju da su zdravstvena anksioznost i psihička komponenta anksiozne osjetljivosti rizični faktori za razvoj kiberohondrije tijekom trudnoće. Brige vezane uz majčinstvo pokazale su se okidačem kiberohondrije. Iako je uočena veza između kiberohondrije i straha od poroda, čini se da strah od poroda nije izravna posljedica kiberohondrije. Anksioznim ženama često nedostaje povjerenje u vlastite roditeljske sposobnosti i mogu se osjećati nepripremljeno za kvalitetnu brigu o djetetu, što može rezultirati pretjeranim internetskim pretraživanjem. Naši rezultati sugeriraju da su upravo brige vezane uz majčinstvo i razdoblje nakon poroda posebno značajne za kiberohondriju. Tijekom pretraživanja za vrijeme trudnoće, žene su više

usredotočene na buduće zdravstvene probleme i nepoznanice oko majčinstva, nego na trenutne simptome. Ovi rezultati ističu važnost suočavanja s tjeskobom vezanom uz zdravlje, kognitivnim brigama u okviru anksiozne osjetljivosti i brigama vezanim uz majčinstvo u prenatalnoj skrbi. Razumijevanje čimbenika koji doprinose kiberohondriji kod trudnica može pomoći zdravstvenim stručnjacima u pružanju ciljane podrške kako bi se ublažilo pretjerano pretraživanje interneta za zdravstvenim informacijama i smanjila tjeskoba tijekom trudnoće. Nalazi se mogu interpretirati u okviru kognitivno-bihevioralnih modela kiberohondrije.

Ograničenja istraživanja

Empirijska istraživanja imaju i neka metodološka ograničenja koja je važno napomenuti. Korelacijsko istraživanje (2. dio) ima ograničenje vezano uz nemogućnost donošenja uzročno-posljedičnih zaključaka temeljem prirode nacrta. U longitudinalnoj studiji (3. dio) sudjelovao je relativno mali uzorak i došlo je do osipanja sudionica tijekom mjerenja. Obje studije zbog online prirode prikupljanja podataka imaju ograničenje vezano uz samo-selekciju i nereprezentativnost uzorka. Unatoč navedenom, istraživački pristup korištenja različitih metodologija u studijama značajno je pridonio ublažavanju ograničenja povezanih s pojedinačnim dizajnom istraživanja.

Zaključak

Zaključno, ova disertacija naglašava efekte koje digitalni svijet ima na psihičko zdravlje trudnica, razjašnjavajući međuodnos između anksioznosti, komplikacija u trudnoći i pojave kiberohondrije. Dobiveni rezultati ukazuju na važnost ciljanih intervencija za kiberohondriju kod trudnica, s naglaskom na podršku ženama s komplikacijama tijekom trudnoće i onima koje doživljavaju intenzivne brige vezane uz majčinstvo. Razumijevanje aspekata kiberohondrije ključno je za stručnjake kako bi prilagodili intervencije za trudnice i pružili im kvalitetnu podršku.

Ključne riječi: internet, zdravstveno pretraživanje informacija, kiberohondrija, anksioznost, zdravstvena anksioznost, anksioznost specifična za trudnoću, anksiozna osjetljivost, strah od poroda, trudnoća, komplikacije u trudnoći

Content

Introduction

In today's digital age, people have access to health-related information from various sources, with the Internet emerging as a primary platform due to globalization and development of modern technologies. In the past, health information gathering predominantly occurred within dyadic relationships, involving interactions between doctors and patients or conversations with trusted individuals. However, the internet has no boundaries, enabling individuals to share and acquire health experiences and opinions from a vast online community (Gui et al., 2017). Nowadays, patients frequently request doctors to recommend web pages where they can expand their knowledge about diagnoses, medical procedures, medications, and more (Kavlak et al., 2012). Apart from the expanded reach of health knowledge exchange online, online health research offers benefits such as speed, anonymity, and ease of access (Prescott & Mackie, 2017). Nonetheless, not everything available online is reliable, which can create an illusion of trustworthiness. Consequently, people may experience heightened health fears due to an overload of information about their medical conditions or procedures (Fleming et al., 2014).

Notably, research indicates that women are more inclined to search for health information online (Bert et al., 2013), particularly during pregnancy (Prescott & Mackie, 2017). Almost all pregnant women turn to the internet to seek information about their health or the postpartum period (Bert et al., 2013). Some studies reveal that for certain pregnant women, online health information leads to feelings of calmness, control, and security in their health decisions (Lagan et al., 2011a). Sharing personal pregnancy experiences online can offer support, empowerment, and normalization when interacting with other users (Hearn et al., 2013). However, some women report feelings of fear, heightened anxiety, or even terror, indicating that online health research may also have negative psychological consequences (Lagan et al., 2011a; Lima-Pereira et al., 2012).

To gain a deeper understanding of the topic of online health research and its effects on pregnant women, this thesis will first provide an explanation of the theoretical models of health and disease, as well as theories on the process of searching for information during pregnancy.

The biopsychosocial model

In the field of medicine, the primary focus for a long time has been on the biological components of health, including the understanding of the causes of mental diseases. Psychiatry, in particular, heavily emphasized genetics, biochemistry, neurobiology, as well as structural and functional changes in the brain when trying to comprehend various diagnoses. However, a significant shift occurred in 1977 with the introduction of the biopsychosocial model (Engel, 1977).

This groundbreaking model not only considers biological factors but also takes into account psychological and social influences, as well as their interactions in understanding the causes of diseases, including mental disorders (Engel, 1977). According to the model, the development of most mental diseases is influenced by biological predispositions, which are further shaped by individual developmental characteristics, psychological states, interpersonal relationships, stress, and significant life events. In essence, the biopsychosocial model recognizes that while biological changes are necessary, they are not sufficient alone to trigger the onset of mental diseases, advocating for a more holistic approach (Papadimitriou, 2017).

Moreover, the severity, course of illness, manifestation of disorders in everyday life, and the effects on a person's functioning can differ significantly based on psychological, social, and cultural factors. This model has contributed to a more empathetic approach in medicine, taking into consideration the broader context in which the patient's health is situated (Papadimitriou, 2017). By embracing the biopsychosocial model, medical practitioners can better understand and address the complexities of mental diseases, leading to more comprehensive and effective care for patients. Embracing the biopsychosocial model has transformed healthcare into a patient-centered approach, where understanding the unique social and psychological context of each individual allows for tailored interventions and strengthens the therapeutic relationship between patients and their healthcare providers.

The biopsychosocial-digital approach to health and disease

The traditional biopsychosocial model has been modified to incorporate a digital component, integrating it with biological, psychological, and social factors related to health and disease. This updated model focuses on how patients experience the interactions of digital health solutions with their health conditions (Ahmadvand et al., 2018).

In today's world, we have access to a wealth of digital data about our bodies. This information comes from healthcare providers and our own self-tracking efforts (Ahmadvand et al., 2018). For instance, smartwatches now measure stress levels, heart rate, physical activity, sleep patterns, blood oxygen levels, blood pressure, and some can even perform electrocardiograms (Massoomi & Handberg, 2019). Portable devices provide valuable health information, particularly benefiting those with limited access to healthcare (Ahmadvand et al., 2018). Mobile applications for health, commonly known as health apps, have become increasingly popular and can serve various purposes (Fiordelli et al., 2013). These apps offer information on fitness, diet and nutrition, sleep, meditation, mental health support, women's health, and chronic disease management. Moreover, they allow users to store and manage their health records (Fiordelli et al., 2013). This digital expansion of our biological information allows us to explore and understand our bodies in new ways, but also receiving the information about its functions whenever we want.

Digital health solutions can have a significant impact on people's psychological functioning, their emotions and behaviors. They can evoke both positive and negative feelings, such as increased confidence in health decisions or heightened anxiety (Ahmadvand et al., 2018). It appears that searching for information on undiagnosed conditions online, especially if serious conditions are mentioned or unreliable sources are used, may influence anxiety levels and behaviors (White & Horvitz, 2009). Interestingly, women tend to experience more escalation and heightened anxiety from exposure to health-related websites compared to men (White & Horvitz, 2009). Healthcare providers need to be ready to address these new psychological aspects of digital health tools.

The impact of the digital component on the social aspects of health is evident, with an increasing trend of health-related interactions taking place online. This trend has both positive and negative effects. On one hand, it allows better access to health information and potentially improves the quality of care for some patients (Ahmadvand et al., 2018). However, there are concerns about algorithms prioritizing certain content in searches, often leading to the display of alarming health diagnoses and consequences that cause worry (Bagarić & Jokić-Begić, 2019). Moreover, the use of social networks and forums can exacerbate health concerns and online behaviors, as users may come across worst-case scenarios shared by others (Bagarić & Jokić-Begić, 2019; Prescott & Mackie, 2017).

As we look ahead, the future of the biopsychosocial-digital model appears promising. The continuous advancements in digital health technologies, like advanced wearable devices and artificial intelligence-driven diagnosis systems, are anticipated to bring revolutionary changes to patient care and disease management (Massoomi & Handberg, 2019; Sunarti et al., 2021). Nevertheless, as we embrace these innovations, we must also address ethical concerns and the potential psychological consequences, such as worry and anxiety, that may arise (Sunarti et al., 2021).

The theoretical models of information seeking during pregnancy

Although there are numerous theoretical models on information seeking, as well as models extended to cover information seeking on the Internet, only a few have been applied in research focusing on pregnant women's information seeking behaviors. These models include the Health Belief Model (Hochbaum, 1958), Theory of Planned Behavior (Ajzen, 1991), Uses and Gratifications Theory (Katz et al., 1974), and two Information Seeking Models (Kuhlthau, 1991; Wilson, 1997). The following two models of information seeking will be described as they serve as the most appropriate theoretical framework for understanding the other aspects of this thesis.

Carol Kuhlthau's model (1991), as examined by Kalbach (2006) in the context of internet information searching, and later expanded upon by Lagan, Sinclair and Kernohan (2010) in their research on pregnant women, describes the emotions, thoughts, and actions experienced at different stages of information seeking. The model underscores the personal importance of information for individuals (Kuhlthau, 1991).

According to the original model (Kuhlthau, 1991), in the first stage of information seeking, individuals initiate the search because they recognize a need for information, often feeling fear and uncertainty in this unfamiliar territory. Then comes the selection stage, where they choose sources to gather more information related to their search, giving them a clearer idea of the available possibilities and thus feeling optimistic. During the exploration stage, they delve deeper into the topic, possibly encountering frustration or confusion due to the abundance of sources. As they narrow their focus on specific information needed, in the next stage, their positivity returns. The collection stage involves gathering the specific information sought, increasing their confidence in the entire search process and sparking interest in the

subject area. After completing the search, individuals may feel satisfaction if they found relevant information or disappointment if their search did not meet expectations.

Kalbach (2006) introduces some changes to the model, explaining the process of searching for information on the Internet in six stages. Initially, when people realize they need information, they take some time to think and find their way to start the search. In the second phase, they select a search engine to continue their search, and the accuracy and availability of search engines become important to them. The third phase involves typing a term into a search engine and contemplating potential search results. Following this, they quickly scan all links and decide which ones to open and study more closely, which is when they experience the most uncertainty and information overload. Subsequently, they open the links, read, and possibly use the information they find, resulting in satisfaction or disappointment based on whether their initial expectations were met.

In addition, Lagan et al. (2010) expand on the model by emphasizing the significance of demographic characteristics, pregnancy status, internet availability, and prior search experience throughout the entire search process. This process encompasses recognizing the need for information, identifying information sources, using the Internet, collecting information, evaluating and utilizing the gathered information, and ultimately making decisions based on the content acquired.

Another frequently mentioned model is Thomas D. Wilson's model (1997), which is built on the premise that information seeking is influenced by the need for information, perceived barriers to successful searching, self-efficacy in searching, and perceived risks and consequences related to the seriousness of a health condition. The motivation for seeking information arises from the need to acquire knowledge, and individuals embark on searching when they possess enough self-confidence in their ability to search effectively. According to the model, individuals with higher information needs and fewer obstacles to accessing information are more likely to engage in information seeking (Wilson, 1997). These barriers encountered during searching may be connected to individual demographic characteristics, psychological traits, interpersonal or environmental factors, or may be linked to the information itself (Wilson, 1997).

Given that pregnancy is a novel experience for women, it typically leads to an increased need for health and pregnancy-related information, motivating women to engage in

information-seeking. Das (2013) includes in the model the knowledge about correct health behaviors and direct experience with pregnancy complications. The author considers both factors important for driving information-seeking and decision-making during pregnancy. The findings from the study conducted on a sample of pregnant women indicated that the need for information, perceived barriers in searching, health knowledge, and women's level of direct experience with pregnancy complications are significant predictors of information-seeking during pregnancy (Das, 2013).

In the next chapter, the phenomenon of cyberchondria will be thoroughly explored, with a focus on its conceptualization and potential implications on mental health.

Cyberchondria

The definition and current conceptualizations

The term "cyberchondria" originates from the combination of "cyber" and "hypochondriasis" suggesting that it pertains to a form of hypochondriasis linked to the Internet or computer use (Starcevic & Berle, 2013). Cyberchondria can be described as a compulsive or repetitive behaviour of seeking health-related information on the Internet, driven by feelings of distress or anxiety about one's health, which in turn further intensifies such distress or anxiety (Starcevic & Berle, 2013). This excessive behaviour can interfere with other activities, leading to negative consequences (Starcevic, 2017).

It is essential to differentiate cyberchondria from occasional or regular health-related searches online, driven by curiosity. Additionally, repetitive searches that offer comfort or a sense of being well-informed are not considered cyberchondria. The defining characteristic of cyberchondria is its tendency to heighten anxiety in the individual (Starcevic & Berle, 2013). It manifests as an abnormal behavioural pattern and emotional state (Starcevic, 2017).

The second approach to cyberchondria, different from the aforementioned definition of cyberchondria as a behavioral pattern, is the one that views cyberchondria as a syndrome (Starcevic, 2020). Key elements for identifying cyberchondria include excessive time-consuming behaviour, compulsion, and repetitive searches, accompanied by distress and physiological reactions. During searches, individuals may seek reassurance and struggle with trusting information found online over their doctor's advice (Starcevic, 2017; Starcevic et al.,

2019). Network analysis has revealed that compulsion, distress, excessiveness, and reassurance are equally important symptoms in defining cyberchondria, with none being more central than the others (Starcevic et al., 2019).

Theoretical frameworks on cyberchondria

Cyberchondria has been explained through various theoretical models. In this section, the reassurance-seeking model, the metacognitive model, and cognitive-behavioural models of cyberchondria will be explored.

The reassurance-seeking model, which was the first model of cyberchondria, offers valuable insights into how individuals behave when seeking information about their health (Starcevic & Berle, 2013). This model suggests that individuals who are health anxious turn to online health research because they want to alleviate their concerns (Starcevic & Berle, 2013). The outcomes of such online searches can vary significantly due to the abundance of information available on the internet. Consequently, some individuals may find reassurance, while others remain distressed (Starcevic & Berle, 2013). When individuals experience a decrease in anxiety after their online research, it is considered classical reassurance and not part of cyberchondria. In contrast, those who experience increased anxiety may react differently. Some individuals may halt their research and avoid seeking further information. Others may persist in their search, potentially leading to the development of cyberchondria (Starcevic & Berle, 2013). If this pattern perpetuates itself, a maladaptive coping mechanism known as *problematic online health research* appears (Starcevic et al., 2020). In this context, online health research serves as a safety behavior, reinforcing health anxiety and the perception of health threats (Starcevic & Berle, 2013).

Metacognitions refer to our beliefs and thoughts about our own thinking processes (Melli et al., 2016). These beliefs are pivotal in shaping how we interpret and manage our cognitive experiences, worries, and other mental states. In the context of psychopathology, metacognitions are essential in understanding how individuals cope with their concerns and can influence the development and maintenance of various psychological disorders (Melli et al., 2016). The metacognitive model of cyberchondria proposes that excessive online health research and its negative effects are linked to specific beliefs about the Internet (Starcevic et al., 2020). These beliefs can be either positive, viewing the Internet as a helpful tool for

dealing with health concerns and believing that worrying is a beneficial, adaptive mechanism safeguarding one's health, or negative, characterized by a sense of uncontrollability and harm associated with online research (Bagarić & Jokić-Begić, 2019; Starcevic et al., 2020). In this context, the distressing and compulsive nature of online health research arises from the unique characteristics of the Internet, resulting in what is termed *compulsive online health research* (Starcevic, 2020). This pattern of behaviour reflects a sense of being out of control when engaging in online research, which can perpetuate cyberchondria (Starcevic, 2020).

As a result, there might be two types of cyberchondria, or pathological/abnormal online health research: problematic and compulsive online health research (Starcevic, 2020; Starcevic et al., 2020). Problematic is more associated with reassurance-seeking and health anxiety, while compulsive is connected to metacognitive beliefs and problematic internet use. Cyberchondria might be a single entity, encompassing both patterns in varying degrees among individuals (Starcevic et al., 2020).

Models of cyberchondria based on cognitive-behavioral theory have emerged (Brown et al., 2020; Schenkel et al., 2021), highlighting the role of previous health-related experiences in shaping health beliefs. These beliefs can be broad and unspecific, making individuals vulnerable to cyberchondria (Brown et al., 2020). Traits like health anxiety, anxiety sensitivity, and intolerance of uncertainty are seen as risk factors contributing to cyberchondria's development (Schenkel et al., 2021). When triggered by aversive feelings or perceived health threats, individuals engage in online health research to seek reassurance, evaluate their health concerns, and gather information for decision-making (Brown et al., 2020). The research can lead to two outcomes: a reassuring one, where they find everything is fine, but may develop a positive metacognitive belief that online research helps control anxiety, leading to future searches; or a worrying one, where negative beliefs emerge about lack of control and harmful consequences, resulting in ongoing reassurance-seeking behaviors - excessive and compulsive research with heightened anxiety, i.e. cyberchondria. Therefore, online health research may have various physiological, emotional, cognitive, and behavioral consequences (Brown et al., 2020; Schenkel et al., 2021). Understanding these pathways is crucial in effectively addressing cyberchondria, which can be seen as a health-related safety behavior maintained by intermittent reinforcement, driven by uncertainty about health (Schenkel et al., 2021).

Interconnections with related psychological constructs

Health anxiety

Several constructs have been connected to cyberchondria in research conducted so far. One of the most prevalent psychological concepts frequently associated with cyberchondria is health anxiety. Individuals grappling with health anxiety tend to experience an overwhelming concern for their health, even when no actual illness is present or when their worry exceeds their symptom experience (McMullan et al., 2019; Schenkel et al., 2021). This predisposition often drives them to delve into online health research. This behavior can arise from interpreting bodily sensations and medical information as indicators of serious illness, thereby causing distress (Brown et al., 2020). Research indicates that health anxiety encompasses a spectrum, ranging from mild unease that fosters health-conscious behavior to pathological anxiety that impairs daily functioning (Vismara et al., 2020).

Numerous studies have consistently demonstrated moderate to strong correlations between cyberchondria and health anxiety, encompassing values from .23 to .68 (Starcevic et al., 2020). One meta-analysis also revealed a robust positive connection between health anxiety and cyberchondria (r = .63) (Schenkel et al., 2021). Among the various subscales of cyberchondria, all exhibited noteworthy associations with health anxiety, with the strongest links observed for distress and excessiveness (Schenkel et al., 2021). Significantly, the emotional facet of health anxiety, particularly the concerns surrounding health, manifested the most potent correlation with cyberchondria. This insight implies that the act of seeking health-related information online may serve as a strategy to alleviate health-related worries (Schenkel et al., 2021).

However, even individuals exhibiting minimal degrees of health anxiety could confront heightened distress when navigating online searches (Vismara et al., 2020). This subset commonly lacks a background of health anxiety and often embarks on online searches driven by curiosity or the emergence of new symptoms (Vismara et al., 2020).

It's important to underscore that the causal connection between health anxiety and cyberchondria remains uncertain due to the cross-sectional design of current investigations (Starcevic et al., 2020). Although heightened health anxiety typically precedes cyberchondria, the act of extensively scouring the internet for health-related information might also trigger or amplify anxiety (Starcevic et al., 2020). Regardless of the chronological order, engaging in

cyberchondria-driven online searches appears to result in heightened levels of anxiety when compared to the state prior to initiating these searches (Starcevic, 2017).

Obsessive-Compulsive Symptoms

The compulsive nature of cyberchondria has been previously discussed. The diagnostic criteria relevant to cyberchondria exhibit an overlap with OCD (Vismara et al., 2020). These shared criteria involve fixating on health-related worries and engaging in repetitive actions like checking and seeking reassurance (Vismara et al., 2020). However, individuals with hypochondriasis perceive their thoughts about illness and the corresponding urge for reassurance as reasonable (ego-syntonic). In contrast, those with OCD typically see their thoughts and urges as groundless (ego-dystonic) (Vismara et al., 2020). Concerning OCD, engaging in repetitive online searches might function as a strategy to alleviate the obsessions (Vismara et al., 2020). This compulsion often arises from the apprehension of missing crucial health information if one ceases their search, resulting in lingering health-related uncertainties (Starcevic, 2017).

Correlations between cyberchondria and OCD symptoms have consistently been strong, ranging from .38 to .56 (Starcevic et al., 2019), indicating higher cyberchondria in those with greater obsessive-compulsive symptoms (Schenkel et al., 2021). The strength of these correlations varies based on the specific aspect of cyberchondria and type of OCD symptoms. For instance, responsibility for harm and contamination fears exhibit stronger correlations compared to unacceptable thoughts and symmetry obsessions (Starcevic et al., 2019).

Different hypotheses explore the relationship between OCD and cyberchondria. Some suggest compulsive elements are part of cyberchondria, while others propose obsessional doubt and the hope for a perfect answer contribute to its maintenance (Schenkel et al., 2021). The compulsivity and reassurance-seeking behavior inherent in both cyberchondria and OCD likely contribute to their relationship (Starcevic et al., 2020). However, regression analyses indicate that after considering negative affect and health anxiety, OCD symptoms do not share significant associations with cyberchondria, suggesting that cyberchondria might be more closely linked to depression or anxiety (Fergus & Russell, 2016).

Intolerance of uncertainty

Intolerance of uncertainty is a conceptualized fear of the unknown (Schenkel et al., 2021), involving a cognitive bias where individuals perceive the possibility of negative events as unacceptable (Vismara et al., 2020). This notion reflects an incapacity to cope with uncertainty in various unpredictable situations (Schenkel et al., 2021). There are two dimensions to it: prospective intolerance of uncertainty, centered on an aversion to uncertainty about the future, and inhibitory intolerance of uncertainty, characterized by a desire to avoid uncertainty and display symptoms of apprehension (Schenkel et al., 2021).

Research indicates a moderately robust association between cyberchondria and inhibitory intolerance of uncertainty, while the link with prospective intolerance of uncertainty is somewhat weaker (McMullan et al., 2019). Intolerance of uncertainty serves as a notable predictor of heightened health anxiety and functions as a moderator in the relationships between health anxiety and cyberchondria, as well as between anxiety sensitivity and cyberchondria (Schenkel et al., 2021).

Problematic internet use

The pervasive characteristics of problematic internet use have been previously examined. Problematic usage of the Internet encompasses a growing array of excessive and time-consuming online behaviors (Vismara et al., 2020). This involves becoming preoccupied with online activities, displaying addictive tendencies, and engaging in behaviors aligned with obsession and impulsiveness (Vismara et al., 2020). There are shared attributes between cyberchondria and problematic internet use: an excessive engagement in online activities, reduced control over these activities, and a persistent continuation of such behaviors despite negative outcomes, including conflicts, neglect of responsibilities, and impaired functioning (Starcevic et al., 2020).

Collectively, the findings point to a significant link between cyberchondria and problematic internet use (Starcevic et al., 2020). Nevertheless, individuals experiencing cyberchondria might also excessively employ the internet for other purposes (Vismara et al., 2020).

Pain Catastrophizing

Pain catastrophizing is characterized by a tendency to obsessively ruminate and fret over pain, leading to an overestimation of its severity (Vismara et al., 2020). Those affected by this inclination often turn to the internet to seek more information about their symptoms, which in turn disrupts their daily life, increases health anxiety, and fosters a habit of excessive health-checking (Vismara et al., 2020). People enduring chronic pain frequently grapple with anxiety and distress concerning the source and implications of their pain, leading them to seek answers online (Schenkel et al., 2021). Research has demonstrated a significant correlation between pain catastrophizing and cyberchondria, even when factors like negative affect and health anxiety are taken into account (Schenkel et al., 2021).

Anxiety sensitivity

Anxiety sensitivity is characterized by anxiety related to anxiety symptoms and a person's fear that these symptoms are dangerous, potentially leading to physical, psychological, or social consequences (Schenkel et al., 2021). It encompasses three distinct dimensions, reflecting various types of concerns: cognitive (concerns about mental functioning), physical (concerns about immediate physical effects), and social (concerns about social rejection due to publicly visible anxiety symptoms) (Schenkel et al., 2021).

All dimensions of anxiety sensitivity are interconnected with cyberchondria, potentially acting as risk factors for its development (Vismara et al., 2020). Those with elevated anxiety sensitivity might interpret sensations and feelings associated with anxiety as harmful, leading them to engage in online health searches to alleviate concerns about the underlying cause of these sensations (Vismara et al., 2020). Health-related internet searches can arise from a range of concerns, encompassing cognitive, physical, and social dimensions (Schenkel et al., 2021).

Interestingly, a study investigating the link between components of anxiety sensitivity and cyberchondria discovered a unique association between physical anxiety sensitivity and research-related distress (Fergus, 2015). This supports the idea that physical anxiety sensitivity contributes to worries about potential illness (Fergus, 2015). Additionally, social anxiety sensitivity shared a unique association with excessiveness. This might be linked to concerns that others might be unsupportive of expressed health concerns, aligning with

observations that social anxiety sensitivity could relate to fears of negative evaluation specifically focused on anxiety symptoms (Fergus, 2015). Furthermore, cognitive anxiety sensitivity shows a distinct connection with compulsion and reassurance, suggesting that cognitive anxiety sensitivity contributes to the perception of illness severity (Fergus, 2015). Individuals strongly believing that having a searched illness would be distressing might become preoccupied with the content online, compulsively searching for further reassurance (Fergus, 2015).

Distinctive features of cyberchondria

The network analysis indicates that cyberchondria is a distinct, syndrome-like construct, characterized by interconnected symptoms that set it apart from related constructs (Starcevic et al., 2019). Cyberchondria displayed its closest correlations with problematic internet use and health anxiety, while its links with general anxiety, depression, OCD symptoms, intolerance of uncertainty, and somatic symptoms were relatively weak. These findings underscore the distinctiveness of cyberchondria. However, the findings do not indicate that cyberchondria should be classified as a diagnosable disorder; further research in this area is necessary.

Consequences of cyberchondria

Cyberchondria has been linked to a range of consequences spanning emotional, cognitive, behavioral, and economic domains.

A significant portion of the general population, around one-third, reported increased anxiety after health-related internet searches (Schenkel et al., 2021). Individuals with higher health anxiety tend to experience heightened negative emotional outcomes from such searches (Schenkel et al., 2021). Negative emotions commonly reported include uncertainty, fear, anxiety, worry, and nervousness, with their intensity often correlating to the level of cyberchondria (Schenkel et al., 2021). Positive emotional outcomes have also been observed, such as feelings of relief and calmness. The act of searching itself can provide reassurance by replacing rumination with proactive information-seeking (Schenkel et al., 2021).

The influence of health-related internet searches on individuals' emotions is shaped by a range of factors, encompassing both personal attributes outlined in the preceding chapter and elements linked to the search process and the nature of the information itself. The length of the search plays a role, with prolonged searches leading to increased anxiety due to the potential discovery of alarming information (Schenkel et al., 2021). Additionally, the type of information found matters - negative emotions arise when unfamiliar or alarming health issues are encountered, especially if the information is inaccurate, misleading, confusing, or perceived as serious (Schenkel et al., 2021). Unfortunately, the reliability of online health information varies, causing individuals with health anxiety to invest significant time in discerning trustworthy sources (Starcevic & Berle, 2013).

Cyberchondria often spills over into individuals' daily lives, affecting personal, professional, and educational responsibilities (Starcevic et al., 2020). Interpersonal relationships may suffer due to the avoidance of feared activities and the adoption of safety behaviors (Brown et al., 2020). Notably, cyberchondria remains linked to functional impairment even after accounting for the effects of health anxiety (Schenkel et al., 2021). There was no observable link between cyberchondria and a reduction in quality of life. These findings could imply that individuals experiencing cyberchondria might find contentment in their lives, despite functional limitations attributed to their specific behaviors linked to cyberchondria (Schenkel et al., 2021).

Individuals with cyberchondria exhibit a complex relationship with healthcare. They tend to engage in excessive body checking (Brown et al., 2020), frequent medical check-ups, and request multiple investigations (Schenkel et al., 2021). However, some may avoid seeking medical assistance when necessary, leading to potential adverse health outcomes (Schenkel et al., 2021). The patient-physician relationship can also be strained, as individuals may withhold information from doctors or disregard medical advice (Starcevic et al., 2020).

The economic burden of cyberchondria is significant, as it contributes to frequent sick leaves and increased use of healthcare services (Starcevic et al., 2020). In the UK, health anxiety alone was estimated to cost approximately £56 million annually (Vismara et al., 2020).

In conclusion, the consequences of cyberchondria extend beyond the digital realm, impacting emotional well-being, daily functioning, healthcare interactions, and economic

resources. Understanding these ramifications is crucial for addressing the multifaceted effects of excessive online health searches.

Cyberchondria in pregnant women

Surprisingly, despite a growing body of evidence pointing to the potentially distressing emotional aftermath of health-related internet searches among pregnant women (Lagan et al., 2011a; Prescott & Mackie, 2017), a significant research gap persists in investigating the phenomenon of cyberchondria within this specific population. While prior research has shed light on certain factors, such as a pregnant woman's perception of having acquired adequate information on a particular topic and her inclination to avoid repetitive searches, which seem to correlate with reduced health anxiety (Prescott et al., 2018), the intricate interplay between these factors and the potential manifestation of cyberchondria during pregnancy remains an unexplored area.

Given the unique emotional and physiological journey that pregnancy entails (Bjelica et al., 2018), there is an inherent complexity in assessing how cyberchondria might manifest and influence the psychological well-being of expectant mothers. The heightened state of vulnerability, coupled with the changes that pregnancy brings, could potentially magnify the impact of health-related online searches, leading to more pronounced anxieties and concerns. Moreover, the evolving dynamics of the patient-physician relationship during pregnancy, where a woman's health decisions frequently intersect with the welfare of her unborn child, coupled with potential pregnancy complications, anxieties about childbirth, postpartum challenges, and maternal responsibilities, could potentially introduce distinct dimensions to the cyberchondria phenomenon and result in more focused and specific online searches.

While existing literature underscores the need for tailored healthcare approaches during pregnancy (Gui et al., 2017), little attention has been directed toward understanding the interplay between cyberchondria and this crucial life stage. As we delve deeper into comprehending the factors that predispose and trigger online health research and cyberchondria in pregnant women, we may uncover novel insights into how socio-demographic, obstetric and psychological characteristics might influence information-seeking behaviors, childbirth perception and overall pregnancy experiences. By addressing this research gap, we have the potential to not only enhance our understanding of cyberchondria's

implications for pregnant women but also inform strategies for providing more effective and empathetic care to this vulnerable population.

Psychological aspects of pregnancy

Pregnancy embodies a complex bio-psycho-social phenomenon, where alongside physical changes, profound psychological shifts occur (Bjelica et al., 2018). These psychological transformations encompass a range of emotions, cognitive adaptations, and altered perceptions of self and the surrounding environment. Pregnancy can be understood as a unique state, capable of exerting considerable stress in some women (Bjelica et al., 2018).

The field of prenatal psychology highlights the substantial role that maternal stress and anxiety play during pregnancy in shaping maternal well-being and fetal development (Bjelica et al., 2018). Stress is a common experience among pregnant women, with 78% reporting low to moderate stress levels during pregnancy, while 6% reported very high stress levels. Various stressors frequently affecting pregnant women include limited material resources, family duties, problems in intimate relationships, and pregnancy complications (Dunkel Schetter & Tanner, 2012).

Maternal physiological changes mirror alterations in the functioning of the sympathetic nervous system, neuroendocrine system, and cardiovascular system. These systems, which influence child development and the timing of childbirth, can have a profound impact (Guardino & Dunkel Schetter, 2014). The theory of fetal programming sheds light on how maternal functioning during pregnancy can affect a child's development. The prenatal environment, maternal physiological state and behaviors, and social context collectively contribute to fetal development, potentially predisposing the child to physical and mental health issues throughout their life (Guardino & Dunkel Schetter, 2014).

Research has revealed that pregnancy is often marked by heightened anxiety, which can have diverse consequences for both the mother and the child. These consequences include adverse impacts on mental health, childbirth outcomes, and the child's psychomotor development (Nakić Radoš et al., 2018). The effects of anxiety during pregnancy encompass a wide range of outcomes such as high blood pressure, nausea, frequent sick leaves, increased doctor visits, preterm birth, difficult childbirth, cesarean section, low birth weight, PTSD

symptoms related to childbirth, breastfeeding difficulties, etc. (Alder et al., 2007; Field et al., 2010; Littleton et al., 2007; Martini et al., 2010; Rubinchik et al., 2005; Qiao et al., 2012, all cited in Anniverno et al., 2013).

Recent years have introduced a novel concept within the realm of pregnancy-related anxiety. Pregnancy-specific anxiety, distinct from general state or trait anxiety, focuses on worrying about both the mother's and child's health, childbirth, finances, close relationships, appearance concerns, child loss, parenthood, and newborn care (Schetter, 2009). Research has shown that pregnancy-specific anxiety is influenced by a diverse range of predictors, indicating that anxiety during pregnancy is a multifaceted phenomenon. Women's concerns during pregnancy encompass various aspects (Arch, 2013). Notably, women with pronounced trait anxiety may exhibit heightened anxiety during pregnancy, interpreting stimuli such as test results or bodily sensations as particularly alarming. Conversely, situations characterized by high medical risk may lead to anxiety in women who were not previously anxious (Guardino & Dunkel Schetter, 2014). Stressful events and anxiety during pregnancy are also risk factors for postpartum mental health issues (Nakić Radoš et al., 2018), with anxiety during pregnancy being a significant predictor of postpartum depression (Andersson et al., 2006). Pregnancy-specific anxiety will be further explored in subsequent chapters of this thesis.

The impact of pregnancy complications on maternal mental health

Pregnancy is a multifaceted experience, with around 15-20% of pregnant women encountering complications (Abrar et al., 2020). A medically high-risk pregnancy arises when there is a potential threat to the well-being of both the mother and the baby, due to pregnancy-related disorders or unique circumstances (Abrar et al., 2020). These complications encompass a spectrum of physical and psychological health conditions that span obstetrical, maternal, and fetal domains (Abrar et al., 2020; Jia et al., 2023). Research underscores a bidirectional relationship between pregnancy complications and mental health. Not only can complications lead to mental health problems (Jia et al., 2023), but women with pre-existing mental disorders also face an increased likelihood of experiencing complications (Runkle et al., 2023).

Common pregnancy complications encompass a wide range of conditions such as anemia, anxiety, depression, diabetes, heart problems, hypertension, hyperemesis gravidarum, infections, and weight issues (Jia et al., 2023). These complications, particularly those occurring in early pregnancy, often prompt emergency medical evaluation and treatment, and can trigger heightened stress, anxiety, depression, and PTSD in affected women (Jia et al., 2023).

About one in five pregnancies is impacted by chronic medical conditions, such as metabolic, circulatory, and respiratory diseases (Brown et al., 2018). Women with conditions like diabetes, hypertension, heart disease, migraine, and other neurological disorders, are more likely to experience heightened anxiety and depression (Brown et al., 2018). One plausible rationale for this correlation could be attributed to the stresses associated with managing their treatment, experiencing sleep disturbances, or dealing with pain (Brown et al., 2018).

Research underscores that pregnancy risk significantly predicts mental health outcomes like depression and anxiety (Rezaee & Framarzi, 2014). Both pregnancy complications and elevated stress levels during pregnancy are linked with increased anxiety during this period (Da Costa et al., 1999; Guardino & Dunkel Schetter, 2014; Nakić & Herman, 2010). Women facing medically complex pregnancies often report higher anxiety symptom levels than those with uncomplicated pregnancies (Abrar et al., 2020). The stress associated with medical management of the condition and frequent hospitalizations, combined with feelings of lack of control and worry about the fetus, contributes to heightened anxiety levels (Abrar et al., 2020). The effects of pregnancy complications extend beyond the immediate timeframe. It seems that complications during pregnancy have implications for maternal health even long after the pregnancy concludes (McNestry et al., 2023).

In the realm of online health research for women facing complications, a study by Kamali et al. (2018) revealed that a majority of women turned to the internet for information when they were ill or experiencing pregnancy-related complications. Notably, the practice of online health research is prevalent among women dealing with complications, often driven by the desire to make well-informed decisions regarding their health (Kamali et al., 2018). Interestingly, the need for support and information seems to intensify for women grappling with pregnancy complications, potentially indicating a lack of sufficient understanding and assistance from their family and friends (Lowe et al., 2009). Leveraging the Internet, which

offers access to health information even on the most uncommon topics, becomes advantageous. Stories shared by others who had undergone similar experiences are especially valued for enhancing emotional comprehension and empathy (Lowe et al., 2009). Nevertheless, it's crucial to recognize that for certain individuals, the fusion of online research and pregnancy risks could potentially amplify feelings of anxiety.

The relationship between pregnancy complications, mental health, and cyberchondria will be further discussed in the second part of this thesis.

Fear of birth

Fear of childbirth encompasses concerns about maternal and child well-being, the birthing process, pain, loss of control, belief in one's own capabilities, worries about parenting, and lack of support (Melender & Lauri, 1999; Wijma et al., 1998). In some cases, this fear can escalate to a pathological level, causing avoidance of pregnancy, a condition known as tokophobia (Hofberg & Ward, 2003). Notably, fear is present in various contexts, including in women who have never been pregnant (primary tokophobia), as well as in both first-time mothers and those with prior birthing experiences (secondary tokophobia) (Dencker et al., 2019).

Fear of childbirth arises from a variety of factors, many of which are intertwined with women's psychological well-being. Heightened anxiety, depression, or PTSD have been identified as factors that increase the likelihood of developing a fear of childbirth (Anniverno et al., 2013; Dencker et al., 2019; Hall et al., 2009). Furthermore, experiences of violence, traumatic gynecological examinations, fear of pain, daily fatigue, sleep deprivation, stress, challenging socioeconomic circumstances, attitudes toward childbirth, concerns about motherhood, traumatic past childbirth experiences, and unwanted pregnancies are all linked to elevated levels of fear (Anniverno et al., 2013; Dencker et al., 2019; Hall et al., 2009). Depression, low self-esteem, and notably, both state and trait anxiety, as well as anxiety sensitivity, have been identified as significant predictors of fear of childbirth (Arch, 2013; Badaoui et al., 2019; Saisto & Halmesmäki, 2003; Spice et al., 2009; Zar et al., 2002). Women experiencing a combination of anxiety and depression are particularly prone to experiencing fear of childbirth (Storksen et al., 2012).

The research exploring the relationship between fear of childbirth and factors such as age, education, and parity presents conflicting findings (Dencker et al., 2019). The majority of studies indicate that fear is more prevalent among primiparous women and those who have previously experienced negative pregnancy and childbirth outcomes (Anniverno et al., 2013). Specifically, first-time mothers often harbor concerns about childbirth, particularly related to the fear of pain, labor complications, and medical procedures (Madhavanprabhakaran et al., 2015). Moreover, it appears that higher income levels can mitigate these fears, as women with greater financial resources tend to have access to more support systems (such as doulas) and a wider range of choices regarding their birthing options (Arch, 2013). For women seeking counseling due to fear of childbirth, research indicates that heightened somatic anxiety and lower stress tolerance are associated with greater levels of fear (Ryding et al., 2007; cited in Hall et al., 2009).

Some women may opt for abortion, encounter complications during labor and delivery, experience prolonged contractions (Anniverno et al., 2013), or even face miscarriage due to the influence of fear (Zar et al., 2002). This fear-driven inclination can also result in a desire to undergo a cesarean section or necessitate such a delivery method due to complications (Zar et al., 2002). Additionally, there is a heightened likelihood of women with elevated fear levels opting for epidural anesthesia (Dencker et al., 2019). Moreover, it appears that women with a higher fear of childbirth often require more frequent psychiatric assistance and pharmacotherapy (Dencker et al., 2019). They are also more prone to postpartum depression, complications, and may encounter challenges related to motherhood and psychological well-being, potentially leading to postponing subsequent pregnancies (Dencker et al., 2019).

Interestingly, one study postulated that fear of childbirth has diminished over time with advancements in analgesia and improved care for pregnant women. However, certain apprehensions like pain, injuries, the fear of dying during childbirth, and the concern of being alone during labor still persist (Anniverno et al., 2013).

The media's portrayal of childbirth contributes to fear and anxiety surrounding the birthing process (Luce et al., 2016). In a study conducted by Fleming et al. (2014), it was discovered that all pregnant women in the sample exhibited elevated fear of childbirth, with none feeling adequately prepared for the experience. It's plausible that the prevalence of internet usage is a contributing factor to this phenomenon. Pregnant women engaging in the

virtual realm are exposed to an overwhelming wealth of information, which might lead them to believe that they can access comprehensive knowledge about pregnancy and childbirth. Paradoxically, this exposure might result in a reduction of fear towards the unknown aspects of childbirth, and instead, a heightened fear of knowing more than they wish to. This notion could intensify the apprehension tied to childbirth, and some women might subsequently realize postpartum that their excessive information consumption had amplified their fear (Fleming et al., 2014). An excess of information, coupled with a lack of comprehension or insufficient knowledge regarding the labor and birth process, as well as conflicting information, can elevate fear (Sheen & Slade, 2018). Women emphasize that their understanding of childbirth and the quality and reliability of the information they receive are pivotal factors influencing fear of birth. These factors can be undermined and questioned when information from the internet comes into play (Sheen & Slade, 2018).

Depression or anxiety disorders during pregnancy are linked to an escalated frequency of doctor visits due to fear of childbirth (Andersson et al., 2004; cited in Hall et al., 2009). Given technological advancements, it is plausible that women in such circumstances might turn to the internet to seek information instead of directly consulting a doctor. However, online information, in certain cases, could potentially exacerbate their anxiety and fear of childbirth, rather than alleviating it.

Nevertheless, it's crucial to acknowledge that an appropriate amount of high-quality information can diminish the fear of the unknown and adequately prepare expectant mothers for childbirth (Bernhardt & Felter, 2004; cited in Lagan et al., 2011). According to a study by Stoll et al. (2015), young women who exhibit more confidence in their knowledge of childbirth tend to experience less fear associated with it. Interestingly, finding information online was not linked to increased confidence in knowledge, whereas those who acquired childbirth knowledge from experts displayed lower levels of fear. In the same study, it was found that fear of childbirth is intertwined with apprehensions about postpartum bodily changes, perceived challenges in accessing reliable childbirth information, and diminished confidence in understanding pregnancy and childbirth (Stoll et al., 2015). Although this study focused on young women without pregnancy experience, its findings could reasonably be extended to the pregnant population.

The relationship between anxiety, cyberchondria, and fear of childbirth will be further elucidated in the third section of the thesis.

Aim of dissertation

The objective of this doctoral thesis is to conduct an in-depth investigation into the impact of the Internet, as an information milieu, on the development and maintenance of psychological difficulties in pregnant women. Specifically, the study aims to explore the phenomenon of cyberchondria among pregnant women, which represents a notable gap in existing literature. Previous research has not yet explored the connection between psychological characteristics and cyberchondria in pregnant women. This doctoral thesis embarked on a comprehensive literature review to identify the current situation in the field and relevant variables of interest. Subsequently, it proceeded to examine the relationship between these psychological and obstetric variables and cyberchondria with cross-sectional study. Finally, it extended its investigation to longitudinally assess the relationship between these variables and childbirth perception throughout pregnancy.

The first part of the thesis (review paper) will encompass an extensive review of existing literature, focusing on the patterns and motivations behind pregnant women's utilization of the Internet for health-related information. This section will delve into the rationale underpinning their online engagement during pregnancy, the specific themes and topics that attract their searches, their perception of reliability of the disseminated information and the repercussions of internet usage on pregnant women. Additionally, this review will explore the demographic, obstetric, and psychological variables associated with online health research behavior. The synthesized knowledge from this comprehensive review will serve as the conceptual foundation for formulating hypotheses for subsequent empirical investigations.

The second part of the thesis (empirical paper) will involve an examination of the determinants of cyberchondria, with a concurrent exploration of potential disparities in cyberchondria severity and anxiety levels among pregnant women based on relevant obstetric variables. This empirical research aims to investigate the interplay between demographic characteristics, obstetric attributes, anxiety, and cyberchondria within the subset of women experiencing medically complicated and medically uncomplicated pregnancies.

The concluding facet of the research trajectory emphasizes a longitudinal perspective. The aim of the third part of the thesis (empirical paper) is to gain a more profound understanding of the risk factors, triggers, and outcomes of cyberchondria among pregnant women. Furthermore, this part will delve into the stability of cyberchondria, anxiety and fear

of childbirth throughout pregnancy. This longitudinal study design enables the identification of potential variations in these psychological constructs as pregnancy advances.

By interconnecting the domains of online health research, cyberchondria, and psychological aspects of pregnancy, this thesis aims to present an engaging and comprehensive exploration into the multifaceted realm of expectant mothers' experiences in the digital age. This holistic approach underscores the importance of understanding of how online health information, cyberchondria tendencies, and emotional well-being intersect for expectant mothers.

Part I.

The importance of the Internet in obtaining health-related information in pregnant women

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Introduction

Today, the Internet is globally available and has become an increasingly used medium that people can employ to simply, quickly, and anonymously obtain information on their health (Prescott & Mackie, 2017). Women are more prone to searching for health-related information on the Internet (Bert et al., 2013), and this is especially pronounced during pregnancy, which represents a very important, complex, and sensitive developmental period in their lives (Prescott & Mackie, 2017). Pregnancy is one of the five most searched health-related terms that people research on the Internet (Spink et al., 2004), and mothers are one of the groups that uses the Internet the most to find health-related information and make decisions on health (Kowalyk et al., 2009). Today, pregnant women are expected to show a high level of activity and involvement in pregnancy and child care and to independently reach decisions on health (Gui et al., 2017). It is also believed that the modern perception of pregnancy results in pregnant women receiving intense medical monitoring, which can lead to pregnancy being viewed as an "illness" rather than a natural state (Gui et al., 2017). It is therefore not surprising that women feel a need to be informed and use every available source of information, such as the Internet.

Current research presents varied data on the number of women that use the Internet to find health-related information. American and Asian studies report that this number is above 75% (Gao et al., 2013), whereas some European studies report a rate of as high as 98% (Bert et al., 2013), which indicates that a large percentage of pregnant women actively use the Internet for health-related searches. Larsson (2009) found that the prevalence of Internet use for pregnancy-related information ranged from once to as many as 62 times per month, while DeClerq et al. (2008) reported a median rate of six hours per month. In one study (Bjelke et al., 2016), the majority of pregnant women searched the Internet for information every week, and a somewhat smaller number searched every day. The majority of pregnant women use the Internet to search for health-related information less that one hour per day, but as many as approximately 40% use it more than one hour per day (Almoajel & Almarqabi, 2016).

One concerning fact is that the majority of pregnant women do not feel ready to give birth. It is possible that internet use contributes to this, because the virtual world exposes pregnant women to a large amount of information that can create the impression that it is simple to find out absolutely everything on pregnancy and delivery. It is therefore possible that pregnant women today no longer fear the unknown factors related to delivery but rather

the opposite: that they know more than they might want (Fleming et al., 2014). However, we must bear in mind that having an adequate amount of high-quality information available can reduce fear of the unknown and prepare women for the process of giving birth (Bernhardt & Felter, 2004).

Since the use of the Internet in pregnancy is a topic of increasing interest to experts in the field, while remaining unexplored in the context of the Croatian healthcare system, the goal of this article was to provide a review of the relevant studies in this field as well as guidelines for future research.

Reasons for using the internet in pregnancy

Pregnant women engage in Internet searches on health-related topics for numerous reasons. Very common reasons reported by pregnant women include the speed and simplicity of acquiring information, the flexibility of Internet access, privacy, curiosity, the large amount of information on the Internet, simple terminology and information that can be accessed free of charge, and the need to confirm that everything is alright with their pregnancy (Lowe et al., 2009; Prescott & Mackie, 2017; Taheri et al., 2018; Tang & Lee, 2006). An advantage reported by pregnant women regarding Internet use is also the less common negative assessments on part of other users in comparison with in-person communication with physicians or loved ones (Walther & Boyd, 2002).

In addition to using the Internet to expand their knowledge, pregnant women also share their experiences, thoughts, and feelings with other online users in order to get support but also to perhaps help other women who find themselves in the same situations (Fredriksen et al., 2016). Receiving support from others on the Internet is especially important to users in times of anxiety and stress (White & Horvitz, 2009), and the same is likely to hold for pregnant women.

Factors associated with searching for health-related information during pregnancy can be divided into facilitating factors, i.e. those that encourage searching, and inhibiting factors, i.e. those that reduce the incidence of searching (Taheri et al., 2018). Pregnant women will be more likely to engage in searching for information if they are encouraged in this by persons close to them, if they are curious and want to find out more information, if they sometimes

felt insufficiently informed on the state of their health and want to change that, and if they have the requisite knowledge to adequately search through the available resources. Searching is also facilitated by support from the healthcare system, a good relationship with the physician, and receiving high-quality information (Taheri et al., 2018). Inhibiting factors are those that make it less likely that pregnant women will engage in pregnancy-related internet searches. One of these factors is a system in which pregnant women do not receive sufficient information from healthcare staff, which further discourages them in searching for the information themselves. If pregnant women have difficulties in finding information in general due to a lack of sources, being inexperienced in searching, or due to experiencing searching as stressful, they will also be less likely to search for health-related information. It is interesting to note that the environment can also be an inhibiting factor for some pregnant women, partially due to persons in their environment not being experienced in searching, but also if these persons are present at medical examinations and completely take upon themselves the role of finding information and making decision regarding the pregnancy (Taheri et al., 2018).

Some pregnant women are unhappy with medical examinations during pregnancy because they do not fully satisfy their needs. Women believe that the initial examination in pregnancy is arranged too late and that checkups at the start of the pregnancy are more sporadic than they would prefer, since they have many questions for physicians (Kraschnewski et al., 2014). The main criticisms associated with the examinations are the long periods of time between two examination and the short duration of the examination, during which pregnant women do not have the time to find out all the information that interests them and do not feel comfortable enough to ask all the questions that they have (Lagan et al., 2011b). Pregnant women report often using the Internet as a “first-aid” solution in the period between examinations when they are worried or anxious because of the symptoms they are experiencing but too embarrassed to repeatedly contact the physician to ask if everything is alright (Gui et al., 2017). Additionally, pregnant women try to be as well-prepared for an examination as possible, so they search for information online before a new medical checkup (Lagan et al., 2010; Prescott & Mackie, 2017). After an examination, they search for information on the Internet to double-check what the physician has told them, understand it better, find out more about a topic that was broached during the examination, or to decide whether they should ask for a second option in addition to the one given to them by their physician (Bert et al., 2013; De Santis et al., 2010; Lowe et al., 2009). Some pregnant women use the Internet to inform themselves when some of their issues are ignored because

they are not dangerous for the child, despite reducing the woman's quality of life (Gui et al., 2017). All the above represents some of the reasons why pregnant women use the Internet to find health-related information, and indicates the issues surrounding medical examinations during pregnancy as well as a lack of attention and support on part of the healthcare system towards some pregnant women. However, in an interesting study by Lagan et al. (2010), a high percentage of pregnant women reported searching the Internet before and after the medical examination, but with 80% of the participants reporting that the searches were not linked to the examination. Further research is needed to get a clearer picture on this topic and form recommendations for physicians if there is a need for a different checkup structure and changes in communication with patients. More detailed explanations of reasons for using specific sources of information found online will be presented below.

Sources of information on pregnancy and search strategies

Today, pregnant women have a large number of sources available that can provide answers to their questions on pregnancy, including information sources found on the Internet. Most women find such information by entering a search term or question that interests them into an internet search engine (Lagan et al., 2011b), while a smaller number uses specific webpages that they visit often and are familiar with (Hu & Sundar, 2010; Lev, 2013). Such webpages have usually been recommended by a member of the family or a friend, and in rarer cases have been recommended by a physician (Almoajel & Almarqabi, 2016) or the media (Lima-Pereira et al., 2012). Most pregnant women conduct internet searches at home on a computer, and some also use a smartphone (Almoajel & Almarqabi, 2016).

Many pregnant women browse the webpages of hospitals or healthcare institutions as well as forums and blogs aimed at pregnant women (Bert et al., 2013). Women view forums as internet spaces where they can anonymously express their intimate problems or opinions, ask for direct instructions on how to act in a given situation, and check if everything is alright with their pregnancy with the expectation that others will not criticize or judge them, as can often happen in face-to-face communication (Gui et al., 2017; Madge & O'Connor, 2006). For some pregnant women, forums are also important because they represent a place where they can obtain support and advice from other women, which might not be available in their environment (Lagan et al., 2011b). However, forums often contain upsetting stories about very complicated pregnancies or deliveries with severe outcomes for the mother or child.

Prescott & Mackie (2017) conclude that pregnant women without pregnancy-related complications rarely visit forums because they do not feel the need to simply write that they are doing fine, thus perhaps leading to additional sorrow and anxiety in pregnant women who are experiencing pregnancy-related problems. This leads to an overrepresentation of upsetting content in forums and to forums being the type of webpage that leads to the most anxiety in pregnant women (Bjelke et al., 2016). Studies have shown that some pregnant women who use forums are more prone to changing their behavior and habits in pregnancy (Bert et al., 2013), and some of them show better awareness and knowledge on health after using forums (Fredriksen et al., 2016).

Pregnant women also often use commercial webpages where various pregnancy-related topics can be found (Almoajel & Almarqabi, 2016), but these pages are mostly focused on selling a product rather than expanding the knowledge of pregnant women. It is interesting to note that pregnant women prefer such webpages to those hosted by nonprofit organizations (Grimes et al., 2014; Lima-Pereira et al., 2012). A possible explanation is that products on commercial webpages are mostly advertised by physicians, which can lead to the impression that the contents are more medically relevant.

The use of social networks is also on the rise, as well as channels with educational videos (Almoajel & Almarqabi, 2016). In addition to enabling pregnant women to regularly find out interesting and practical information about pregnancy, social networks also serve as a place where pregnant women can share their experiences in pregnancy and present the new aspect of their self-image, that of a mother (Johnson, 2014). Some pregnant women use social networks because they also find it relaxing and because the use of social networks allows them to regularly communicate with persons close to them as well as expand their social network (Holtz et al., 2015). Some pregnant women also use social networks for educational purposes (Kraschnewski et al., 2014), which can be problematic if the contents are not medically accurate and reliable. On the other hand, an advantage of video materials on the Internet reported by pregnant women is that they can view it repeatedly if they did not understand something on the first viewing (Lupton, 2016). It is important to emphasize that pregnant women who watch videos of deliveries to educate themselves consequently experience an extremely high level of fear (Fleming et al., 2014).

Pregnant women also often use pregnancy-related smartphone applications. Smartphone applications are perceived as useful because they offer notifications associated

with the development of the fetus, healthy diet, or topics of importance at certain weeks of the pregnancy (Dorst et al., 2019). Applications focused on information of fetal development can have a useful calming effect by presenting information that shows that the symptoms the pregnant women are experiencing are common and normal (Lupton, 2016). However, they might also lead to an increase in anxiety if the woman does not experience a feeling or symptom that is predicted for a given week of the pregnancy, despite that not necessarily being an indication of a problem. Some pregnant women also use the application to simplify the motoring of their body weight, activity, moods, checkup schedule, test results, etc. (Spink et al., 2004). One study (Hearn et al., 2013) attempted to find out more details on what would represent an ideal source of information for pregnant women. The participants agreed that this would be a personalized mobile application that contained links to reliable webpages that provide quick and simple answers. They also wanted the application to be synchronized with their location and provide information on relevant events for pregnant women in their area.

A very important question is how pregnant women know when they have found enough information on the topic they were searching for. The most common answer provided by women is finding identical information from several sources on the Internet and when no new information has been found for some time (Lagan et al., 2011b; Prescott & Mackie, 2017), which can be problematic if the information in question is incorrect. A very high ratio of pregnant women, approximately 80%, visit more than one webpage in search for a given piece of information (Hu & Sundar, 2010). Furthermore, pregnant women stop searching when they feel they are satisfied with the information they have found (Lagan et al., 2011b) or when they are under the impression that the information has calmed them (Prescott & Mackie, 2017). They also discontinue the search when the information found is no longer helpful (Prescott & Mackie, 2017). Some women find it challenging to stop reading Internet content and continuing to search. One participant in the study by Prescott & Mackie (2017) stated that she had a hard time stopping searching if she was very upset and anxious, although she was aware that further information searches may just increase the anxiety and insecurity she felt. Situations in which pregnant women find different information from different sources and are unsure which is correct may also lead to constant further searching and consequently to increased anxiety in pregnant women. Furthermore, the results of the Lupton study (2016) are concerning. Although the availability of the Internet via smartphone has its advantages, some pregnant women described using their phone for constant online searches if they become concerned about a pregnancy-related topic, especially during the night.

Search topics in pregnancy

Studies have reported that there is a large number of topics that interest pregnant women and for which they search the Internet. Most researchers have found that fetal development is the most-searched topic (Bert et al., 2013; Larsson, 2009; White & Horvitz, 2009). Important topics also include diagnosis and testing in pregnancy, pregnancy complications, physiology and stages of pregnancy and delivery, changes in pregnancy, lifestyle of pregnant women, information on physicians, the relationship with the partner, and phychological assistance for pregnant women (Almoajel & Almarqabi, 2016; Bert et al., 2013; Larsson, 2009). A high percentage of pregnant women also searches for information on teratogens (De Santis et al., 2010) and taking medication in pregnancy (Lagan et al., 2010). Pregnant women often search for information on healthy diet during pregnancy as well as products for mothers and children (Larsson, 2009). A higher level of knowledge on the process of pregnancy, the child, and delivery leads to higher self-confidence in the mother as well as a feeling of control, confidence in parental competence, and calmness, if the mother finds out that she and the child are healthy based on the information she finds (Bjelke et al., 2016; Prescott & Mackie, 2017).

Topics for which pregnant women search the Internet differ somewhat based on the trimester of the pregnancy. In the first trimester, they actively search for information that confirms whether a child has been conceived and follow all the symptoms that indicate whether everything is alright with the pregnancy. They also search for information on abortion and changes that happen in the everyday life of the pregnant woman. In the second trimester, they are more focused on ambiguous symptoms that can indicate the presence of some complications, on information about the child's movements, and on information about caring for themselves and the child. The third trimester is focused on preparations for delivery, so their need for information is focused on that topic as well as on fear of giving birth (Gui et al., 2017). As the term approaches, searches on methods for less painful delivery, best places for childbirth, infant health, and breastfeeding become more prevalent (Bert et al., 2013).

There are also differences in search topics between women who are pregnant for the first time and those who have previously experienced pregnancy. Primiparae search for more information on symptoms that indicate pregnancy, on fetal development, physical activity,

pregnancy complications, sexuality during pregnancy, methods of childbirth and for reducing pain during childbirth, and infant feeding and care (Kamali et al., 2018).

A portion of pregnant women, 33%, reported that they wanted to find out more information on how to properly care for themselves and the child during pregnancy. They wanted to find out more about the breastfeeding process, easier and faster recovery after childbirth, and health after childbirth (Grimes et al., 2014). They also wanted more information aimed at strengthening their competencies as new parents and not just information focused on the child (Hearn et al., 2013). They also reported that they wanted to learn this kind of information from experts, who simultaneously offer them support and question their need for information (Singh et al., 2002).

Reliability of pregnancy-related information on the Internet

Individuals who use the Internet more often to find health-related information trust such information more than information provided by the physician and consider the Internet a more useful source of information (Gauld & Williams, 2009). Pregnant women receive a large amount of advice from their environment and are surrounded by various sources of information, but it is very challenging to discern which information on the Internet is correct and reliable and can be trusted completely (Teres, 2002). There are millions of webpages that cover various topics related to pregnancy, but only 4% of these contents were created or sponsored by experts (Kaimal et al., 2008), which is very problematic. Some of the online content aimed at pregnant women is incorrect, can be confusing, or has not been scientifically established (Lagan et al., 2006). Some pregnant women reported often encountering information that is inconsistent, incomplete, or lack references to sources (Fleming et al., 2014), so whether pregnant women consider online information to be reliable is an important question.

Studies have provided contradictory results related to how much pregnant women trust health-related information found on the Internet. While some studies report that pregnant women do not believe online information to be reliable (Lagan et al., 2011b; Prescott & Mackie, 2017), others show that a fairly high ratio of pregnant women believe the information they find online (Grimes et al., 2014; Larsson, 2009; Sayakhot & Carolan-Olah, 2016). Some pregnant women display a critical approach to online information and are aware that

information found on the Internet is not universally useful to every pregnant woman (Lagan et al., 2011b).

Only 11% of pregnant women are aware of the indicators that show whether an Internet page is of high quality, but 70% are still able to list at least one of the indicators. This finding is alarming because some pregnant women could consider themselves experts in searching the Internet but in fact be unable to recognize inaccurate contents (Lagan et al., 2010). Pregnant women believe webpages written by experts and those webpages that are most famous and most used (Kavlak et al., 2012). They often do not check for references at the end of the text (Almoajel & Almarqabi, 2016), which would indicate that the contents are based on facts (Weiss & Moore, 2003), nor do they check the publication date and whether the information is still relevant (Lagan et al., 2010).

Pregnant women are more inclined to believe webpages of hospitals or other institutions of the healthcare system (Lagan et al., 2011b) since they know that the texts on these webpages are written by experts and based on facts, not just the opinions of other pregnant women (Prescott & Mackie, 2017). For example, most content found on forums and social networks has been written by pregnant women who mostly do not have a medical education or detailed knowledge of all the circumstances and the clinical picture of other women. Making health-related decisions based exclusively on information found on webpages not written by experts can be risky, and inaccurate and unconfirmed information can give pregnant women a false sense of security in situations in which they should seek professional assistance (Fleming et al., 2014). However, some pregnant women appreciate reading the experiences of others and consider it less important whether all the information in that context is fully accurate (Fredriksen et al., 2016).

Women often check the accuracy of information they find by consulting a person they trust or using some source other than the Internet (Lagan et al., 2010). This is especially common when they encounter different information on different pages and are not sure which source to trust (Hearn et al., 2013). They are also more likely to check information found on the Internet than information received from experts or loved ones (Prescott & Mackie, 2017).

Studies have found contradictory results on whether pregnant women discuss information found on the Internet with experts managing their pregnancy. Lagan et al. (2011) reported that most women discuss such information with their physician, whereas Larsson

(2009) described the opposite and showed that most pregnant women do not share information found on the Internet with experts. Some pregnant women were prepared to ask their physician about information they found on the Internet, but were not willing to reveal the source of the information to the physician (Fredriksen et al., 2016). However, in a study by Lagan et al. (2010) most pregnant women reported that discussing information found on the Internet with their physician went well. Patients often expect the physician to initiate the conversation on searching for health-related information online (Diaz et al., 2002), and pregnant women reported that they would consider webpages recommended by their physicians to be reliable (Hearn et al., 2013; Johansson et al., 2010).

Characteristics associated with searching the Internet in pregnant women

Demographic and obstetric characteristics

Studies have provided findings that indicate the importance of some demographic and obstetric characteristics in pregnant women with regard to engagement in searching for health-related information on the Internet. Merrell (2017) stated that when searching for information online it is important that pregnant women have a research-focused attitude and that they are motivated to find high-quality information for their own wellbeing and that of their child.

Although a study by Grimes et al. (2014) did not find age-related differences in searching the Internet in pregnant women, those younger than 25 and older than 34 use the Internet as the most common source of information. On the other hand, De Santis et al. (2010) found that age in pregnant women was associated with Internet use and that women aged 26 to 35 use online searches the most. After this group, pregnant women above 36 year of age were the next most likely to engage in online searching, whereas those younger than 25 were least active in searching for health-related information. Congruently, Fredriksen et al. (2016) found that 90% of women aged 25 to 34 used the Internet to find health-related information.

Highly-educated pregnant women are more likely to use the Internet to search for health-related information (Grimes et al., 2014), likely due to having more experience with technology and using the Internet to find health-related information, and thus also more experience in assessing the reliability and application of information (Lagan et al., 2010). Persons with higher education are more prone to checking sources and references cited in

information found on the Internet (Almoajel & Almarqabi, 2016). However, some studies (Larsson, 2009; Lima-Pereira et al., 2012) found no differences in searching habits based on education in pregnant women.

Parity is also a predictor for searching the Internet more often, and some studies found it was the most significant predictor (Leune & Nizard, 2012). Women who are pregnant for the first time are more prone to searching for online information compared with those who already experienced childbirth (Bert et al., 2013). It is logical that primiparae feel the need to be well-informed about the state they are in, and the Internet is one of the channels they use to find information on pregnancy and health. For these women, pregnancy is a new, unknown, and challenging phase in their lives, and they want to make sure the child is healthy and strive to be well-informed when taking up the role of a mother (Shieh et al., 2010). However, it is interesting that some researchers did not find any parity-dependent difference in the approach to finding information (De Santis et al., 2010; Prescott & Mackie, 2017).

There is a reduction in the frequency of online searches during the pregnancy, as the moment of delivery approaches. The number of pregnant women engaging in online searches is highest in the first trimester, and there is a sharp drop in search frequency in the second trimester (Gao et al., 2013). Larsson (2009) reports that most pregnant women search for information on the Internet at the start of the pregnancy, and a smaller number searches at approximately equal rates in all trimesters. The start of a pregnancy is a period filled with questions and uncertainty for pregnant women, so it is logical that this is the period they spend the most time searching for pregnancy-related information.

Women with complications in pregnancy are an extremely vulnerable group, and they frequently search for information about pregnancy (Kamali et al., 2018), as do pregnant women who become sick during pregnancy. They often search for online information at the point when they are still not sure of a given diagnosis because they are waiting for test results or an examination that will potentially confirm the diagnosis. After the diagnosis is confirmed, they can find more detailed information on the Internet on the specific state they are in compared with written materials and information they receive at the examination, which is especially important if they have a complication that is rarer and less well known (Lowe et al., 2009). Many pregnant women also want confirmation that the treatment they are receiving is the best possible option, and thus use the Internet to inform themselves on the treatment. In addition to using the Internet as an additional source of information on their

medical state, they also search for support and empathy from other pregnant women. The realization that other persons are also coping with the difficult situation they themselves are in can be very helpful and reduce the feeling of loneliness and stress, especially if the woman is considering abortion or lacks proper support from physicians (Lowe et al., 2009). Pregnant women who experienced complications in a previous pregnancy consider the Internet useful in finding support (Rillstone & Hutchinson, 2001). Additionally, pregnant women who felt they had not been as informed regarding health as they would have wanted during a previous pregnancy will try to be more informed in the current one (Lowe et al., 2009).

Health literacy

Health literacy refers to the level to which an individual engages in searching for health-related information, how easily they obtain, process, asses, and understand such information, and ultimately how competently they make decision on health based on this information (Grimes et al., 2014; Lagan et al., 2011b). In addition to technological literacy, health literacy is especially important today, when women are surrounded by various information on pregnancy, the accuracy and relevance of which it is difficult to assess. The existence of large amounts of information available to pregnant women should not be considered a factor that is a sufficient indicator of them being well-informed, since it is possible that they do not understand some of the information. Patients generally need professional help to clarify health-related information (Gazmararian et al., 2005), which indicates the importance of the inclusion of healthcare workers in the process on informing patients via the Internet.

A significantly higher percentage of women with a high health literacy uses the Internet to find information on pregnancy compared with those who have low literacy (Shieh, Mays et al., 2009). Health literacy develops by searching for and exchanging information (Shieh, McDanie et al., 2009), so it is important that pregnant women share the information they find with people from their environment, especially experts. The level of health literacy in women has an effect on knowledge on health and health behaviors (Shieh, Mays et al., 2009) and leads to an increase in pleasant interactions with physicians (Neter & Brainin, 2012). Pregnant women who see themselves as more experienced in searching for information on the Internet and assessing their accuracy also have a clearer picture of the questions that

they want to ask the physician and are more involved in making decisions on the pregnancy (Lagan et al., 2010).

Self-efficacy and health-related locus of control

Self-efficacy is considered the basis for human motivations for engagement in certain behaviors, and refers to the individual's belief in their capacity to successfully execute behaviors and achieve their desired goals (Bandura, 1977). Self-efficacy associated with a woman's own abilities is extremely important during pregnancy and after childbirth. Women with greater self-efficacy are more successful at controlling fear of delivery and are more physically active following childbirth (Hinton & Olson, 2001; Lowe, 2000). As for self-efficacy in the context of the confidence of women in successfully obtaining and employing health-related information from the Internet, those with greater self-efficacy and higher self-confidence in that area are consequently more likely to engage in online searches (Campbell, 2009; Shieh et al., 2010). Pregnant women with lower health literacy also have reduced self-efficacy and more barriers in caring for themselves during pregnancy and in using the Internet to obtain information (Shieh, Mays et al., 2009).

The health-related locus of control is the individual's belief that they themselves influence the state of their health through their own actions or the belief that someone else, such as experts, has greater influence on their personal health. Some persons also believe that some divine being, fate, or a greater power leads to improvement or deterioration of personal health. Given the above, a person can believe in an internal locus of control, in an external locus of control in a different person, or a locus of control based on accident. Shieh et al. (2010) found that an internal locus of control, i.e. the belief of the pregnant women that her actions influence the health and wellbeing of the child, is associated with more frequent engagement in searching for pregnancy-related information on the Internet. Such women are also more likely to engage in responsible and healthy behaviors and have a healthy lifestyle (Haslam et al., 2003). Women with lower health literacy are more likely to have an external locus of control and believe that the expert is most responsible for their health in pregnancy (Shieh et al., 2010). Furthermore, an association has been found between locus of control and self-efficacy. Pregnant women with an internal locus of control also have higher self-efficacy regarding searching for health-related information (Shieh et al., 2010).

Anxiety

Caring for one's own health and the health of the child is adaptive, because a pregnant woman that cares will try to check whether everything is alright with the pregnancy and practice a healthy lifestyle. However, severe anxiety in pregnancy is unhealthy for both the mother and the child (Guardino & Dunkel Schetter, 2014). High levels of anxiety during pregnancy have numerous negative consequences for the physical and psychological health of the mother as well as for preterm birth, longer labor, higher prevalence of C-sections, parental self-efficacy, motoric functioning and health of the child, and cognitive and emotional functioning in the child (Buss et al., 2011; Dipietro et al., 2006; Huizink et al., 2017; Johnson & Slade, 2003; Kramer et al., 2009; Nakić Radoš et al., 2018). A study on a Croatian sample found that 35% of pregnant women were highly anxious during pregnancy, but the level of anxiety was reduced after childbirth (Nakić Radoš et al., 2018). Women who were pregnant for the first time can be more anxious than multigravidae because pregnancy includes new and unknown experiences and bodily changes. It is important to emphasize that, for the more anxious pregnant women, searching for information online can be a way to cope with their fears (Shieh et al., 2010).

In some people, searching for health-related information on the Internet leads to increased *health anxiety* and concern. Persons with health anxiety are very concerned about their health even though they are not suffering from any disease. They frequently worry about the physical sensations in their body, which they are prone to interpreting as dangerous symptoms (Kowalyk et al., 2009). Persons with health anxiety are prone to more frequent and longer online searches for health-related information, and they are especially likely to join in discussions on Internet forums (Baumgartner & Hartmann, 2011). Studies have shown that persons with health anxiety experience more negative effects of online searches and visit physicians more often (Eastin & Guinsler, 2006; Muse et al., 2012). Kowalyk et at. (2009) found that health anxiety was elevated in pregnant woman who had complications in pregnancy. Pregnant women who are aware that they have found a sufficient amount of information on their topic of interest, as well as those who do not repeat searches on the same topic, have a lower level of health anxiety (Prescott et al., 2018).

Studies on anxiety in pregnancy have shown that there is a specific type of anxiety that is characteristic for pregnant women. This is called *pregnancy-specific anxiety*, which is described as an uncomfortable emotional state characterized by worrying about the health of

the child, one's own health, delivery, and about finances, close relationships, and one's appearance (Schetter, 2009). Anxiety in pregnancy is more common in younger, unmarried women who have lower education and income, those who are primiparae, who did not want the pregnancy, or have increased anxiety as a personality trait and psychological state (Arch, 2013). Additionally, anxiety in pregnancy can manifest in women who are more anxious overall, but also in those who did not have elevated anxiety previously (Guardino & Dunkel Schetter, 2014). Some women with elevated anxiety in pregnancy avoid any situations that could lead to more pronounced anxiety, which includes searching for information on the Internet or continuing to search for information after they have become upset by the information they have found. In contrast, other women constantly search for new information, attend testing and examinations often, and find it hard to stop searching for information on pregnancy online (Prescott et al., 2018). In these pregnant women, anxiety can be higher after online searches than before them, especially since persons anxious about the state of their health are prone to looking for negative information that can scare them instead of information that can calm them down (Owens et al., 2004). Pregnant women with pregnancy-specific anxiety are more prone to risky behavior in pregnancy such as consumption of alcohol and cigarettes (Arch, 2013; Westerneng et al., 2017). Furthermore, the presence of pregnancy-specific anxiety is a better predictor of negative pregnancy outcomes than other anxiety constructs (Schetter, 2009; Westerneng et al., 2017).

The effects of Internet use on pregnant women

It has been shown that information obtained on the Internet influences the everyday functioning of pregnant women and the decisions they make, for example regarding the method of delivery (Gui et al., 2017; Nikolova & Lynch, 2015). Based on health-related information pregnant women find on the Internet, they examine the diagnosis established by the physician, assess expert recommendations, and evaluate the treatment they have undergone or are about to go through. Studies show that some pregnant women are more willing to change their health behaviors and habits after an internet search (Bert et al., 2013; Huberty et al., 2013). In a study by Lagan et al. (2010), most pregnant women considered information they found online to be useful. Obtaining accurate and reliable information during pregnancy is associated with reduced complications (Javanmardi et al., 2018), lower

incidence of C-section (Shahidi et al., 2011), and lower mortality in the mother and child (Beigi et al., 2009).

Using the Internet in pregnancy has numerous beneficial effects. Conducting an online search can result in a feeling of empowerment, being in control, and feeling secure in making some decisions (Lagan et al., 2011b). Many women feel much more informed, more prepared to talk with physicians during their examinations, and more actively involved in the care they are receiving (Lagan et al., 2011b; Prescott et al., 2018). Women who are better informed more frequently engage in activities that are beneficial to them and the child, thus promoting the importance of being informed about health (Shieh et al., 2010). Some pregnant women feel calmer, more content, more self-confident, and less lonely after a conversation with other pregnant women on the Internet (Bjelke et al., 2016; Lima-Pereira et al., 2012; Prescott & Mackie, 2017). Experiencing support from other people who are or have been pregnant is associated with more successful adjustment and better preparedness to challenges arising after childbirth (Hoddinott & Pill, 1999). Another positive side of searching for information online is sharing information found on the Internet between the pregnant woman and her partner, which leads to their relationship becoming closer during the pregnancy (Kraschnewski et al., 2014).

On the other hand, some pregnant women do not always have a positive experience with Internet use. Lagan et al. (2011b) reported that some pregnant women feel anxious and under stress because of the information they found in an online search, whereas they were not necessarily anxious before the search. In that study, women mentioned that during online searches on complications in pregnancy they often encounter terrifying stories from other pregnant women that upset them greatly. It is certainly important to consider that the probability of encountering terrifying stories from other pregnant women is higher on the Internet compared with persons in one's environment (Prescott & Mackie, 2017). When pregnant women were overwhelmed and overburdened by a large amount of information on the Internet, the reliability of some of which was in doubt, they felt anxiety, fear, and sometimes even paranoia (Lagan et al., 2011b). Some pregnant women were so upset by information they found on the Internet that they consequently requested assistance from experts (Prescott & Mackie, 2017) or people close to them (Almoajel & Almarqabi, 2016; Bjelke et al., 2016). Women who read health-related information on the Internet on a daily basis were more likely to contact their physician due to anxiety caused by the information in

comparison with women who read information online once per week (Bjelke et al., 2016). Pregnant women mostly avoid information what can severely upset them or exacerbate their anxiety, such as videos of childbirth (Lupton, 2016). In addition to being upset, some pregnant women felt confused by the information they obtained on the Internet (De Santis et al., 2010), while some felt frustrated by being unable to find what they were looking for (Lima-Pereira et al., 2012).

When pregnant women find information on the Internet that calms them down, it is interesting to note that the calming effect is shorter in comparison with the effect of information received in face-to-face conversations. However, information on the Internet provided to them by experts also has a longer effect (Prescott & Mackie, 2017), which indicates that the source of the information is more important than the medium when the pregnant women are feeling anxious.

Conclusion

The wide availability of the Internet has allowed pregnant women to actively and frequently obtain information via the Internet. Pregnant women who are motivated to find information and have a research-focused attitude are more involved in monitoring their pregnancy and in participating in decision-making (Taheri et al., 2018). Given the large amount of information that can be found on the Internet, pregnant women have to be able to assess the reliability of the information, but must also have the capacity to cope with the large amounts of available information. Although for some pregnant women the Internet symbolizes a positive environment where they can receive support and understanding, pregnant women must be careful due to the upsetting contents that can be found in online spaces.

The behavior of pregnant women on the Internet is significantly influenced by their physicians, for whom it would be desirable to take the initiative in starting a discussion on information found on the Internet during examinations. Gynecologists should be familiar with high-quality Internet pages and smartphone applications that they can recommend to pregnant women. It would be desirable for physicians to check how aware their pregnant patients are of the criteria used to assess the quality and reliability of information on the Internet and, if they are not sufficiently aware, indicate the most important criteria. Additionally, given their

expertise, it would be ideal for physicians to actively engage in creating Internet content for pregnant women. International research shows that only a small number of healthcare professionals learns about the importance of internet searches for their patients during the course of their education and that they are unaware of the reliability criteria for webpages (Lagan et al., 2011a), which is certainly an indication that more effort is needed to improve and modernize educational programs.

Searching for health-related information on the internet is not a replacement for the support pregnant women receive in real life, offline (Prescott & Mackie, 2017). A cooperative relationship with the physicians and a large amount of support, warmth, and care directed at the pregnant women from the people around her are extremely important in this important period in life. However, using the Internet is part of everyday life for most pregnant women, and further research is therefore necessary regarding the behavior of pregnant women on the Internet and the effects that the Internet has on their health and welfare. Although some psychological characteristics in pregnant women and characteristics of sources and contents on the Internet have been found to be associated with more frequent Internet use, a clearer picture of the mechanisms that contribute to contentment or anxiety in pregnant women after online searches is yet to be elucidated. The topic deserves a large amount of attention from researchers given the numerous potential practical implications of study findings within the framework of the educational system and emphasizing the importance of health literacy, but also in the context of the health of pregnant women and their children as well as improvement of the healthcare system as a whole.

Part II.

Predictors of cyberchondria in pregnant women

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Introduction

The Internet is a globally widespread medium through which people can anonymously and quickly access health information (Prescott & Mackie, 2017). Women are more likely than men to search for health information online (Bert et al., 2013) and their tendency to engage in such behavior becomes more frequent during pregnancy (Prescott & Mackie, 2017). While for some women online health information seeking leads to empowerment, calmness, and increased self-confidence (Lagan et al., 2011a; Lima-Pereira et al., 2012; Prescott & Mackie, 2017), for others it leads to more unpleasant feelings (Lagan et al., 2011a).

Pregnancy is an anxiety-provoking state, with evidence indicating that 10-40% of pregnant women experience symptoms of anxiety (Abrar et al., 2020). Some studies focus on the increase of health anxiety during pregnancy (Kowalyk et al., 2009; Saadati et al., 2021), which is defined as overwhelming concern for health, even when no actual illness is present or when worry exceeds the symptom experience (Schenkel et al., 2021). The others emphasize the importance of pregnancy-specific anxiety (Hadfield et al., 2022). This is an emotional state characterized by worrying about one's own as well as the child's health, childbirth, finances, close relationships, concerns about appearance, child loss, parenthood and newborn care (Bayrampour et al., 2016). Pregnancy-specific anxiety focuses specifically on concerns related to pregnancy, childbirth, and parenting, and it is distinct from the broader nature of general anxiety, state anxiety which is linked to temporary stressors, and trait anxiety representing a consistent tendency towards worry (Bjelica et al., 2018; Huizink et al., 2004). It is a better predictor of negative pregnancy outcomes than other anxiety constructs (Dunkel Schetter & Tanner, 2012) and is recommended to be used as an anxiety measure during pregnancy. Some women avoid all information and situations that could lead to a further increase of anxiety (Prescott et al., 2018), while others are constantly looking for new information and find it hard to stop seeking information (Owens et al., 2004). Women who are pregnant for the first time may be more anxious than those who have already given birth because pregnancy involves unfamiliar experiences and physical sensations (Shieh et al., 2010). Also, they are more likely to search for information online (Bert et al., 2013).

Women with a *medically complicated pregnancy* (MCP) report higher levels of anxiety symptoms compared to those with a *medically uncomplicated pregnancy* (MUP) (Abrar et al., 2020). It is expected that women experiencing a medically high-risk pregnancy often search for information online (Kamali et al., 2018). The Wilson's model of information seeking assumes that information seeking depends on the need for information, perceived

searching barriers, self-efficacy and perceived risks due to the severity of the condition. People who have higher information needs, perception of higher health risks and fewer obstacles in obtaining information are more inclined to seek information (Wilson, 1997). The model was extended by Das (2013) to better understand information seeking in pregnant women. This model indicated that health knowledge and women's level of direct experience with pregnancy complications play an important role in information seeking. Women with MCP may have a stronger perception of pregnancy risks, which results in higher anxiety, as well as more narrowed focus to pregnancy-specific information during health research (Abrar et al., 2020; Das 2013).

The elevation of anxiety that occurs in some pregnant women after searching for health information online can be connected to the term cyberchondria. Cyberchondria is often defined as an excessive search for health information on the Internet accompanied by unpleasant emotions (Starcevic et al., 2020). Although it is systematically found that cyberchondria is associated with some constructs, there are indications that it is a distinct entity (Schenkel et al., 2021). The network analysis indicates that cyberchondria is a distinct, syndrome-like construct, characterized by interconnected symptoms that set it apart from related constructs (Starcevic et al., 2019). Cyberchondria displayed its closest correlations with problematic internet use and health anxiety, while its links with general anxiety, depression, OCD symptoms, intolerance of uncertainty, and somatic symptoms were relatively weak. These findings underscore the distinctiveness of cyberchondria.

Surprisingly, although multiple findings show that pregnant women can have unpleasant emotional reactions after searching for health information (de Santis et al., 2010; Lagan, Sinclair, and Kernohan, 2011; Lima-Pereira, Bermúdez-Tamayo, and Jasienska, 2012; Prescott and Mackie 2017), cyberchondria has not yet been studied in this group. One study showed that in pregnant women, awareness that they had found enough information on a topic and the tendency not to repeat the same search again are predictors of lower health anxiety (Prescott et al., 2018), which may be indirectly associated with cyberchondria. However, this, as well as other studies, did not explicitly delve into cyberchondria as a concept in pregnant women, leaving it largely unexplored within this specific population.

The purpose of the present study was to examine the role of demographic variables, parity, health anxiety and pregnancy-specific anxiety in cyberchondria among women with

MCP and MUP. We expected that complications in the current pregnancy will contribute to elevated health anxiety, pregnancy-specific anxiety and cyberchondria.

Health anxiety and pregnancy-specific anxiety were expected to play somewhat different roles in predicting cyberchondria among women with MCP and MUP. Pregnancy-specific anxiety was expected to predict cyberchondria in both groups above and beyond health anxiety. We expected that health anxiety would not be a unique predictor of cyberchondria in the MUP group. Specifically, we anticipated that the MUP group will follow the usual pattern of predictors for cyberchondria, where more intense health and pregnancy-specific anxiety would significantly and independently predict cyberchondria. In contrast, complications in pregnancy will narrow the focus to pregnancy-specific worries and information needs. Therefore, we anticipated that only pregnancy-specific anxiety would predict cyberchondria in the MCP group.

This study will be the first one to investigate the phenomenon of cyberchondria in women with MCP and MUP. The study may shed further light on possible predictors of cyberchondria in pregnant women and give inputs for future research. Moreover, it could potentially have implications in managing health-related and pregnancy concerns in expectant mothers. Given the long-term effects that anxiety has on a mother and child (Huizink et al., 2017), this area of research is extremely important.

Materials and methods

Participants and procedure

This cross-sectional study collected data on participants who were recruited online and from the Department of Gynaecology and Obstetrics at the University Hospital Centre Zagreb, Croatia. They completed a set of questions and scales via a research link. The link was shared by the authors in various Facebook groups and pages that bring together pregnant women, as well as on forums and websites often visited by pregnant women. In order to obtain a larger sample, an invitation to participate in the study was placed in waiting rooms where pregnant women wait for regular pregnancy check-ups at the hospital. Also, medical staff at this clinic invited participants to join the study if they wished so. The participants accessed the questionnaire independently by scanning the QR code. The only criteria for participating in the survey was that women were pregnant at the time of completing the

questionnaire and that they were older than 18 years. All participants gave their informed consent online before filling out the questionnaire. The time required to fill out the questionnaire was about 10-15 minutes.

According to G*Power, version 3.1. (Faul et al., 2007), with an estimated power of .80 and an effect size of .05, it was necessary to recruit 263 participants. A total of 418 participants responded to the survey, of which 360 completed the cyberchondria scale measuring the construct of interest. Participants with higher education more frequently completed the whole survey ($\chi 2$ (1) = 5.64, p = .018), as well as those who were employed ($\chi 2$ (3) = 11.48, p = .009) and who had MCP ($\chi 2$ (1) = 4.17, p = .041). These findings are not unexpected given that research shows that women who are more educated, employed and have MCP are more likely to be highly interested in the topic of this survey (Grimes, Forster, and Newton, 2014; Kamali et al., 2018; Kavlak et al., 2012). No differences between those who completed and did not complete the entire survey were found in age, economic status, relationship status, week of pregnancy, parity and complications in previous pregnancy.

In our final sample, we included 360 pregnant women, averaging at 28.2 weeks of pregnancy (SD = 9.4, range: 5 – 42 weeks). In order to answer the research questions, participants were divided into MCP and MUP groups. Women who stated that they did not have any complications in pregnancy were included in the MUP group, and those who stated that they had a pregnancy with maternal or fetal complications that led to more frequent medical appointments or hospitalization were included in the MCP group. In the final sample, 251 women reported they were not experiencing any complications in their current pregnancy, and 50 participants were recruited from the hospital, while all other participants joined the study via online sources. Descriptive statistics can be found in Table 1.

Table 1

Descriptive statistics for participants in the medically uncomplicated pregnancy (MUP; n = 251) and medically complicated pregnancy (MCP; n = 109) groups

		MUP group		MCP group			
Age		*M*	*SD*	*M*	*SD*	*t*	*p*
		29.8	4.7	30.8	4.4	-1.75	.080
		n	*%*	*n*	*%*	χ^2	*p*
Education level	Elementary and High school	103	41.0	42	38.5	.20	.656
	University	148	59.0	67	61.5		
		n	*%*	*n*	*%*	χ^2	*p*
Parity	Primiparous	136	54.2	50	45.9	2.10	.147
	Multiparous	115	45.8	59	54.1		
Week of pregnancy		*M*	*SD*	*M*	*SD*	*t*	*p*
		28.4	9.9	27.8	8.2	.53	.594

Before conducting all analyses, we checked whether the socio-demographic and obstetric characteristics of the participants differ depending on whether they were recruited online or in the hospital. In our sample, more of the women who were recruited online were primiparous ($\chi2(1) = 10.92$, $p = .001$), while women recruited in the hospital had more progressed pregnancies (t (358) = 2.46, $p = .015$; for women recruited in the hospital M = 31.2, SD = 10.2; women recruited online M = 27.7; SD = 9.2). No differences were found on the scales of cyberchondria, health anxiety and pregnancy-specific anxiety. Therefore, all analyses are provided for the total sample.

The research was approved by the ethics committee of the Faculty of Humanities and Social Sciences, Department of Psychology in Zagreb (reference number: EPOP – 2021 – 023) and the ethics committee of the University Hospital Centre Zagreb (reference number: 02/21 AG).

Measures

The questionnaire consisted of socio-demographic and obstetric questions, questions related to the use of the Internet during pregnancy, the health anxiety scale, the pregnancy-specific anxiety scale and the cyberchondria scale.

Health anxiety was measured with the Short Health Anxiety Inventory (SHAI) (Salkovskis et al., 2002). The questionnaire consists of 18 items – 14 items related to health care measures and sensitivity to sensations and bodily changes and the remaining 4 items measuring the expected severity of disease consequences. Each item has 4 response options that are scored from 0 to 3, and the task of the participant is to assess which answer best describes her condition. The total score can be expressed as the sum of the responses on the subscales or on all of the items together (Salkovskis et al., 2002). We decided to use the sum of all items as a total score for further analyses. The scale has good validity and reliability (Kowalyk et al., 2009). In this study, the reliability of the whole scale was Cronbach's alpha $\alpha = .83$, and $\alpha = .81$ and $\alpha = .73$ for the first and second subscales, respectively.

Pregnancy-specific anxiety was measured with the Pregnancy Concerns Scale (PCS) (Nakić Radoš et al., 2015), which measures specific worries that occur during pregnancy. The scale consists of 16 items and has 4 subscales - Concern for the health of the fetus, Concern for one's own health and childbirth, Concern for finances and close relationships and Concern for one's own appearance. The scale consists of a list of difficulties for which the participant must assess how much each has worried her in the last month on a scale from 0 ("I was not worried at all") to 3 ("I was extremely worried"). The scale shows good reliability, sensitivity and convergent and constructive validity. The authors recommended calculating the total result on the scale as the sum of the results on all items. In this study, the reliability of the whole scale was Cronbach's alpha $\alpha = .84$.

Cyberchondria was measured with the Short Cyberchondria Scale (SCS) (Jokić-Begić et al., 2019). It measures negative emotional reactions to health information online and compulsion to further search for information. This scale consists of 4 items to which the participants answer on a scale from 1 ("strongly disagree") to 5 ("strongly agree"). The scale shows very good validity and reliability and its biggest advantage is that it is very short and easy to apply. In this research, the reliability of the whole scale was Cronbach's alpha $\alpha = .78$.

Statistical analyses

The Statistical Package for the Social Sciences, version 22.0 (SPSS Inc., Chicago, IL, USA) was used for all data analyses. The level of statistical significance was set at $p < .05$.

One-way MANOVA was performed in order to establish the difference in health anxiety, pregnancy-specific anxiety and cyberchondria among women with MCP and MUP. A correlation analysis was performed in order to investigate the relationships between the variables. Pearson correlation coefficients were calculated between the continuous variables, Point-biserial correlation coefficients were calculated between parity and other continuous variables and between education level and other continuous variables, and Phi correlation coefficient was calculated between parity and education level. Finally, in order to establish the predictors of cyberchondria, hierarchical multiple regression analyses were conducted.

Results

In our data, 6 univariate outliers were detected and subsequently omitted. No multivariate outliers were found. According to the indices of asymmetry and flatness (Kim, 2013), all variables were normally distributed. Variance inflation factor (VIF) values showed no indications of multicollinearity (in all conducted analyses, VIF values were less than 2).

Differences in health anxiety, pregnancy-specific anxiety and cyberchondria depending on pregnancy complications

One-way MANOVA was performed to check for differences in the severity of health anxiety, pregnancy-specific anxiety and cyberchondria between women with MCP and MUP. There was a statistically significant difference in anxiety and cyberchondria depending on pregnancy complications (F (3, 356) = 5.27, p = .001; Wilk's Λ = .96, partial $\eta 2$ = .04). Pregnancy complications had a statistically significant effect on health anxiety, (F (1, 358) = 12.59; $p < .001$; partial $\eta 2$ = .04), pregnancy-specific anxiety (F (1, 358) = 10.16; p = .002; partial $\eta 2$ = .03) and cyberchondria (F (1, 358) = 3.96; p = .011; partial $\eta 2$ = .01). A Bonferroni correction was calculated to account for multiple ANOVAs being run. Women with MCP had higher scores on the health anxiety (M = 13.3, SD = 5.2; MUP group M = 11.1,

SD = 5.7), pregnancy-specific anxiety (*M* = 19.0, *SD* = 6.9; MUP group *M* = 16.0, *SD* = 7.9) and cyberchondria scales (*M* = 10.1, *SD* = 3.3; MUP group *M* = 9.3, *SD* = 3.5).

Predictors of cyberchondria in pregnant women

We conducted hierarchical regression analyses in order to check the anticipated differences in predictors of cyberchondria in a sample of women with MCP and MUP. Prior to the analyses, correlation coefficients were calculated between the variables (Table 2). Among women with MCP, we found a positive correlation between health anxiety and pregnancy-specific anxiety with cyberchondria. Meanwhile, in women with MUP, age, education level, health anxiety, and pregnancy-specific anxiety were positively correlated with cyberchondria.

Table 2

Correlations and descriptive data among studied variables (above the diagonal are values for women with medically complicated pregnancy (MCP; n = 109) and below are values for those with medically uncomplicated pregnancy (MUP; n = 251))

	1.	2.	3.	4.	5.	6.	7.	*M*	*SD*
1. Age	-	.34**	.32**	-.04	.06	.04	.03	30.8	4.4
2. Education level	.30**	-	.03	.11	.19	.03	-.04	-	-
3. Parity	.27**	-.18*	-	.02	.13	-.11	.05	-	-
4. Week of pregnancy	-.02	.02	-.06	-	-.07	-.12	-.05	27.8	8.2
5. Health anxiety	.21**	.18**	-.02	-.09	-	.50**	.25**	13.3	5.2
6. Pregnancy specific-anxiety	-.05	-.05	-.07	-.06	.43**	-	.30**	19.0	6.9
7. Cyberchondria	.17**	.14*	-.03	-.04	.37**	.44**	-	10.1	3.3
M	29.8	-	-	28.4	11.1	16.0	9.3	-	
SD	4.7	-	-	9.9	5.7	7.9	3.5		-

*$p < .05$; **$p < .01$

Hierarchical multiple regression analyses were conducted with cyberchondria scores as the dependent variable. In the first step, the control variables age, education level and parity were entered. Health anxiety was entered in the second step and pregnancy-specific anxiety in the third step.

Table 3

Results of hierarchical regression analysis for cyberchondria as a criterion, analyzed with a sample of women with medically uncomplicated pregnancy (MUP) and medically complicated pregnancy (MCP)

	MUP group				MCP group			
	β	ΔR^2	ΔF	*df*	β	ΔR^2	ΔF	*df*
Step 1		.04	3.38*	3,246		.01	.18	3,104
Age	.16*				.03			
Education level	.08				-.06			
Parity	-.07				.04			
Step 2		.16	48.32**	1,245		.07	7.63**	1,103
Age	.08				.05			
Education level	.03				-.11			
Parity	-.04				.00			
Health anxiety	.42**				.27**			
Step 3		.05	15.28**	1,244		.04	4.68*	1,102
Age	.11				.02			
Education level	.06				-.09			
Parity	-.03				.05			
Health anxiety	.30**				.14			
Pregnancy-specific anxiety	.25**				.25*			
Total R^2		.25				.12		

*$p < .05$; **$p < .01$

The results of these analyses are shown in Table 3. The predictors of cyberchondria among pregnant women with MUP were health anxiety and pregnancy-specific anxiety, while for women with MCP the only predictor was pregnancy-specific anxiety. Pregnant women with MUP and with higher health anxiety and pregnancy-specific anxiety also exhibited higher cyberchondria, while women with MCP and higher pregnancy-specific anxiety also showed higher cyberchondria. Pregnancy-specific anxiety in both groups of women had an independent contribution to the explanation of cyberchondria, in addition to health anxiety. In the final model for women with MUP, 25% of the variance in cyberchondria was explained. However, among women with MCP, the final model explained 12% of the variance.

Discussion

The aim of this research was to study the phenomenon of cyberchondria and anxiety in women with MCP and MUP. Our research hypotheses were confirmed. Women with MCP had higher health anxiety, pregnancy-specific anxiety and cyberchondria in comparison to those with MUP. Also, pregnancy-specific anxiety predicted cyberchondria in MCP and MUP groups above health anxiety. However, health anxiety was significant predictor of cyberchondria only in the MUP group.

The observation that more primiparous women were recruited online, while those in the hospital were at more advanced pregnancy stages aligns with our expectations. Previous research highlights that first-time mothers tend to seek pregnancy information online (Bert et al., 2013). Additionally, in Croatia, there's a trend of more frequent mandatory hospital check-ups during the latter stages of pregnancy.

Pregnancy can be an anxious time for women, especially if it is accompanied by medical complications. Pregnant women who experience complications in pregnancy are very focused on the child's and their own health (Guardino and Dunkel Schetter, 2014; Kowalyk, Hadjistavropoulos, and Jones, 2009), so it is not surprising that they search for information about health on the Internet. Previous research has found that these women often seek health information online (Kamali et al., 2018) because they want to be informed and make the right health decisions. Once they receive confirmation of a diagnosis, they can find more information about their condition online, which is especially important if they have an uncommon complication (Lowe et al., 2009). Many pregnant women also want online

confirmation that the treatment they are receiving is the best available option. According to the model of cyberchondria (Starcevic & Berle, 2013), some women may find it difficult to stop seeking new health information online, feel anxious after completing the search and develop cyberchondria.

Women with MCP often need to complete additional examinations and medical appointments and, in this way, may receive more health information to worry about and are more likely to find out that something unfortunate is happening during pregnancy. All previously mentioned may lead to increased health anxiety in women with MCP (Kowalyk et al., 2009). According to cognitive-behavioral model of health anxiety, frequent medical check-ups provide temporary reduction of anxiety, but ultimately only maintain health worries since patients seek for reassurance from a medical professional each time the fear reappears (Schenkel et al., 2021). The same applies to online health research, but the outcomes of such reassurance seeking are less predictable and may result in cyberchondria (Bagarić and Jokić-Begić, 2019; Starcevic, Berle, and Arnáez, 2020).

An interesting finding to arise in this study is that health anxiety and pregnancy-specific anxiety were predictors of cyberchondria in women with MUP, while the most important predictor of cyberchondria in women with MCP was pregnancy-specific anxiety. Health anxiety and cyberchondria shared a smaller proportion of variance in the MCP group (6.3%) compared to the MUP group (13.7%). Furthermore, the shared variance between health anxiety and pregnancy-specific anxiety was higher in women with MCP (25%) compared to the MUP group (18.5%). This indicates that, in the MCP group, the part of the explained variance in cyberchondria might overlap between health anxiety and pregnancy-specific anxiety. According to the models of information seeking (Das, 2013; Wilson, 1997), specific information needs, women's level of direct experience with pregnancy complications and perceived risks for health increase the likelihood of searching for health information. Women with MCP have more pregnancy-complication focused information needs and a stronger perception of higher health risks. Their higher health anxiety may manifest through more pregnancy-specific worries during online research. Medical complications narrow the focus of health anxiety to specific pregnancy problems, thereby focusing online health research to specific topics.

From our regression analysis, it appears that there is a possibility that pregnancy-specific anxiety is a mediator in the relationship between health anxiety and cyberchondria.

Notably, in the MCP group, health anxiety ceased to significantly predict cyberchondria in the final regression step, indicating a potential mediating effect. It's plausible that in women with MUP, this mediation could be partial, whereas in those with MCP, it might be complete. However, this needs to be further explored and confirmed using a longitudinal study design.

A greater amount of variance in cyberchondria was explained in the MUP group compared to the MCP group. Apart from a smaller proportion of variance shared between variables in the MCP group, some other explanations of this finding are possible. For instance, in the context of health anxiety, women with MCP may exhibit more pregnancy-focused worries due to their specific complications, potentially restricting their online searches, since the amount of information that can be found online about a specific complication is limited. This targeted search might result in elevated anxiety but diminished cyberchondria, leading to weaker correlations and explaining the reduced variance in cyberchondria among women with MCP. Conversely, another plausible scenario is that certain women with MCP, who were not anxious before pregnancy or before learning about complications (Guardino and Dunkel Schetter, 2014), might intensify their health-related online research after discovering these issues. Over time, this increased focus on health information seeking may perpetuate repeated searches, leading to elevated cyberchondria despite initially lower anxiety levels. These interpretations are hypotheses that offer possible insights into the relationship between health anxiety and cyberchondria among pregnant women with MCP. Further research is essential to validate these hypotheses and better comprehend the dynamics between these variables.

The observed lower percentage of variance explained in women with MCP could also stem from the complexity of their condition. Factors beyond those included in our study, such as the severity and specific nature of their pregnancy complications, might play pivotal roles in cyberchondria development. Moreover, it's plausible that unmeasured psychosocial or medical variables contribute significantly to cyberchondria levels, thus influencing the variance explained by our model. In future investigations, exploring variables such as anxiety sensitivity, intolerance of uncertainty, and pain catastrophizing could provide valuable insights into cyberchondria among pregnant women, particularly those with complications. Additionally, considering socio-demographic factors like socioeconomic status, social support, and previous mental health history could offer a more comprehensive understanding of cyberchondria development within this population.

Some of the limitations of this research include online data collection, participant self-selection and non-representativeness of the sample, all of which may affect the validity of the conclusions (Fenner et al., 2012). Another limitation arises from the fact that no information was collected regarding women's anxiety before pregnancy, nor the obstetrical outcomes of their current pregnancies. As such, we do not have data regarding possible changes of the measured psychological characteristics in pregnant women, nor whether there are any consequences of cyberchondria for women and children. Additionally, our study's cross-sectional design restricted our ability to explore certain mechanisms, notably impeding our research of the mediation role of pregnancy-specific anxiety as discussed earlier.

Conclusion

To the best of our knowledge, this is the first study to examine cyberchondria and its predictors among pregnant women. It is important for health-care providers to be attentive to anxiety in all pregnant women and provide advice to reduce online health research if it is upsetting. It would be beneficial to inform women about verified health-related websites and include the topic of anxiety and cyberchondria in educational courses. For most pregnant women, using the Internet is a part of their everyday life. As such, it is necessary to further study their online health behaviors and the effects that Internet use has on their well-being.

Part III.

Longitudinal assessment of risk factors, triggers, and outcomes of cyberchondria in pregnant women

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Introduction

Pregnancy is a sensitive period characterized by numerous changes that necessitate women's adaptation (Bjelica et al., 2018). Consequently, it is common for women to experience pregnancy-related worries and anxiety (Bayrampour et al., 2016). In an effort to alleviate their anxiety, many women turn to the Internet, making it a primary medium for accessing pregnancy-related information (Prescott & Mackie, 2017). When experiencing anxiety, some women fall into a maladaptive pattern of online searches, leading to a condition known as cyberchondria (Owens et al., 2004). Cyberchondria is defined as an excessive, compulsive and repetitive online health research accompanied by increased distress (Starcevic et al., 2020).

According to cognitive-behavioral models of cyberchondria (Brown et al., 2020; Schenkel et al., 2021), previous health experiences contribute to the formation of health beliefs as a predisposition to vulnerability for cyberchondria. These trait characteristics, such as health anxiety and anxiety sensitivity, serve as risk factors for developing cyberchondria. Additionally, the decision to search for health information is influenced by current health circumstances, known as triggers for online research. For instance, the perception of potential health threats and the experience of worrisome symptoms can elicit aversive affective states, prompting individuals to turn to online research (Brown et al., 2020; Schenkel et al., 2021). According to these models, online health research can lead to different cognitive, behavioral, and emotional consequences. In some cases, research may alleviate anxiety, provide reassurance, and lead to the termination of the search process. However, the habit of internet use can persist due to negative reinforcement. Alternatively, online health research can exacerbate anxiety and distress, resulting in decreased functioning, rumination, and a propensity for further online health research (Brown et al., 2020; Schenkel et al., 2021).

Research systematically demonstrates a strong association between health anxiety, anxiety sensitivity, and cyberchondria, indicating that these trait characteristics serve as predictors of cyberchondria (Schenkel et al., 2021). Individuals with health anxiety exhibit excessive worry regarding their health, even in the absence of actual illness, which increases their likelihood of engaging in online research (Starcevic et al., 2020). Pregnant women who repeatedly search for the same health information online exhibit higher levels of health anxiety (Prescott et al., 2018). Anxiety sensitivity is characterized by heightened anxiety in response to anxiety-related symptoms, accompanied by a person's belief that these symptoms may have dire consequences (Schenkel et al., 2021). This construct encompasses three

distinct dimensions, each reflecting different types of concerns: cognitive (related to mental functioning), physical (concerning physical effects), and social (pertaining to worries about social rejection due to outwardly visible anxiety symptoms) (Schenkel et al., 2021). Individuals experiencing anxiety sensitivity often resort to online research due to their belief that these anxiety symptoms might lead to harmful outcomes (Schenkel et al., 2021). All dimensions of anxiety sensitivity are interconnected with cyberchondria, potentially serving as risk factors for its development (Schenkel et al., 2021). Anxiety sensitivity has been identified as a predictor of distress and worries during pregnancy, childbirth, and postpartum (Spice et al., 2009).

Pregnancy is a period characterized by a multitude of concerns, including the health of the child, personal health, childbirth, finances, close relationships, appearance, and parenthood. Consequently, it is unsurprising that many women experience pregnancy-specific anxiety (Bayrampour et al., 2016). For health-anxious and anxiety-sensitive women, the significant life changes during pregnancy and heightened focus on health and physical sensations, often perceived as threatening, can trigger online research. If pregnant women's online research becomes accompanied by heightened anxiety and becomes excessive, it may indicate the presence of cyberchondria (Starcevic et al., 2020). As a result, this can lead to even greater worry and fear surrounding pregnancy and childbirth (Badaoui et al., 2019).

Research aim

We aimed to examine the risk factors, triggers and outcomes of cyberchondria in pregnant women. Our hypothesis was that trait markers such as health anxiety and anxiety sensitivity would be identified as risk factors, current pregnancy concerns would serve as a trigger, and fears related to childbirth would be an outcome of cyberchondria.

Materials and methods

Participants and procedure

This longitudinal study collected data at three time points: early pregnancy (14-19 weeks), mid-pregnancy (24-29 weeks), and late pregnancy (34-39 weeks). Initially, 160 pregnant women agreed to participate in our research. However, 11 provided only sociodemographic information without completing subsequent assessments. In first

measurement point, we had 110 participants who completed the full questionnaire and shared their e-mail contacts for continued participation. Out of these, 100 engaged in the second measurement point, and 82 continued to the third (Table 4).

Table 4

Descriptive statistics by measurement points

		1.early pregnancy		2. mid-pregnancy		3. late pregnancy	
n		149		100		82	
Age		*M*	*SD*	*M*	*SD*	*M*	*SD*
		30.1	4.7	30.2	4.5	30.7	4.4
Pregnancy weeks		16.7	1.3	27.3	1.6	37.2	1.5
		n	*%*	*n*	*%*	*n*	*%*
Education level	Elementary and high school	62	41.6	40	40.0	28	34.1
	University	87	58.4	60	60.0	54	65.9
Parity	Primiparous	60	40.3	39	39.0	36	43.9
	Multiparous	89	59.7	61	61.0	46	56.1

Participants were recruited online, by sharing the research link in platforms frequented by pregnant women, and offline, by invitations placed in the waiting rooms of the Department of Gynaecology and Obstetrics at the University Hospital Centre Zagreb and private gynecological clinics in Croatia. Medical staff at these clinics invited patients to join the study through the research link.

During the first measurement point, participants indicated their willingness to participate in future measurements and received e-mail invitations based on the provided contact. We initially recruited participants based on two criteria: being over 18 years old and within the appropriate pregnancy weeks. Subsequently, we maintained this group across the second and third measurement points, with a continued emphasis on their pregnancy weeks. Informed consent was obtained before filling out the questionnaire.

The research was approved by the ethics committee of the Faculty of Humanities and Social Sciences, Department of Psychology in Zagreb (EPOP-2021-023) and the ethics committee of the University Hospital Centre Zagreb (02/21AG).

Measures

The questionnaire included the same measures at each measurement point: socio-demographic and obstetric questions, Internet use during pregnancy, and the following scales:

Health anxiety was measured by the Short Health Anxiety Inventory (SHAI) (Salkovskis et al., 2002). The inventory consists of two subscales: Illness Likelihood (health care and sensitivity to sensations and bodily changes; 14 items) and Negative Consequences (the expected severity of the consequences of the disease; 4 items). Each item has four offered answers that are scored from 0 to 3.

Anxiety sensitivity was measured with the Anxiety Sensitivity Index (ASI-3) (Taylor et al., 2007). This scale has 18 items and contains three subscales – Physical Concerns (the fear of physical symptoms of anxiety); Cognitive Concerns (the fear of cognitive symptoms of anxiety); and Social Concerns (the fear of public disclosure of anxiety), all answered on a scale from 0 (*very little*) to 4 (*very much*).

Pregnancy-specific anxiety was measured with the Pregnancy Concerns Scale (PCS) (Nakić Radoš et al., 2015) which measures 16 specific concerns during pregnancy for which the participant must estimate how much it worried her in the last month on a scale from 0 (*didn't worry me at all*) to 3 (*extremely worried me*). The authors validated the scale and established a four-factor structure in one time point with multiple cross loadings (Nakić Radoš et al., 2015). However, our exploratory factor analysis revealed that while the factor structure remained consistent in the corresponding trimester, considering all three time points, the structure is better described by five subscales: Health Concerns, Motherhood Concerns, Financial Concerns, Social Relations Concerns, and Concerns about Looks. The scale is available on request from the authors. It is important to note that although the PCS was included in the most recent systematic review of pregnancy-related anxiety scales worldwide and its cultural significance was recognized (Hadfield et al., 2022), it has not been validated in English for use with participants in low- or middle-income countries, unlike scales such as the Pregnancy-Related Anxiety Questionnaire, Cambridge Worry Scale, Tilburg Pregnancy

Distress Scale, and Pregnancy-Related Anxiety Scale, which have been validated for use in other populations (Hadfield et al., 2022). The authors suggest that further validation of pregnancy-related anxiety scales in different languages and cultural contexts, including the PCS, should be pursued in future research (Hadfield et al., 2022).

Cyberchondria was measured with the Short Cyberchondria Scale (SCS) (Jokić-Begić et al., 2019). Its four items measure negative emotional reactions to health information online and compulsion to search further, and are answered on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

Fear of birth was assessed using the Fear of Birth Scale (FOBS) (Richens et al., 2018), consisting of two items. The task was to indicate the level of anxiety and fear about the upcoming birth on a visual analog scale ranging from 0 (*calm/no fear*) to 100 (*worried/strong fear*). The total score was calculated as the mean of the two items divided by 100.

Reliability ranged from .70 to .95 (McDonald's ωt_{ot} and Cronbach α; Appendix 1), except for the Social Relations Concerns subscale, which was not included in the analyses due to low reliability.

Data analysis

Total scores were calculated as means of available data for each subscale and compared across three time points using Friedman's repeated measures analysis of variance and Durbin-Conover test post-hoc. Spearman correlations were calculated for each time point separately. These analyses were done due to deviations from normality and on all data available for a specific analysis.

To see if cyberchondria is predicted first by health anxiety/anxiety sensitivity and then by pregnancy concerns, and if it predicts fear of birth, we tested a sequential mediation. It was examined by comparing two series of nested models in a cross-lagged path framework (Little, 2013), one series with health anxiety as the predictor, and the other with anxiety sensitivity. The models compared were: (a) autoregressions model including autoregression of each variable from the previous time point and covariation within the same time point, (b) model with additional lag-2 autoregressions, (c) the full mediation model with regressions from predictors in the first time point to the first and second mediators and the outcome in the second time point; from the first mediators in the first time point to the second mediator and

the outcome in the second time point; and from the second mediator in the first time point to the outcome in the second time point, as well as all these regressions from the second time point to the third, and (d) reciprocal effects model with those regressions in the opposite direction (from outcome/mediator to mediator/predictor).

Full information robust maximum likelihood estimation was used due to deviations from normality and missing data. Adequate model fit was determined by CFI > .90, and RMSEA and SRMR < .08 (Little, 2013). The analyses were performed using R 4.0.2 (*lavaan* and *psych*) and jamovi 2.3.26.

Results

Mean levels, changes and correlations

Most scores were generally low to moderate, except for health-related pregnancy concerns and fear of birth, which were closer to the midpoint of the scale (Appendix 1). There were no significant changes across three time points in all variables but two. The motherhood-related concerns were lower in the first trimester compared to the second (Durbin-Conover statistic = 2.04, p = .044) and third (Durbin-Conover statistic = 2.58, p = .011), with no difference between the second and third (Durbin-Conover statistic = 0.54, p = .588). No changes in fear of birth were found between the first and second trimester (Durbin-Conover statistic = 1.00, p = .319), nor second and third trimester (Durbin-Conover statistic = 1.78, p = .077). However, fear of birth was lower in the first trimester compared to the third (Durbin-Conover statistic = 2.78, p = .006). Most of the variables were correlated, and all of them positively (Appendix 3).

Mediation models

Concerning the model with health anxiety as a predictor, adding lag-2 autoregressions and the mediation regressions significantly improved the fit and resulted in a well-fitting model (Table 5). The addition of reciprocal regressions did not significantly change the fit, so the mediation model was chosen as the best (Figure 1a).

Table 5

Fit and differences between cross lagged models of sequential mediation in three time points (N = 149)

Predictors	Model	Model fit					Model difference	
		χ^2	*df*	CFI	RMSEA [90% CI]	SRMR	χ^2	*df*
Health anxiety	Autoregressions	297.50***	176	.917	.069 [.055, .082]	.135		
	Lag -2 autoregressions	250.25***	168	.945	.057 [.042, .072]	.115	37.60***	8
	Mediation	172.96***	126	.968	.05 [.029, .067]	.078	76.98***	42
	Reciprocal	134.18***	84	.968	.062 [.041, .081]	.056	41.13	42
Anxiety sensitivity	Autoregressions	463.44***	225	.883	.083 [.072, .094]	.148		
	Lag -2 autoregressions	389.33***	216	.917	.071 [.06, .083]	.131	48.55***	9
	Mediation	274.10***	162	.947	.066 [.052, .079]	.109	114.72***	54
	Reciprocal	202.39***	108	.957	.072 [.057, .088]	.066	74.19*	54

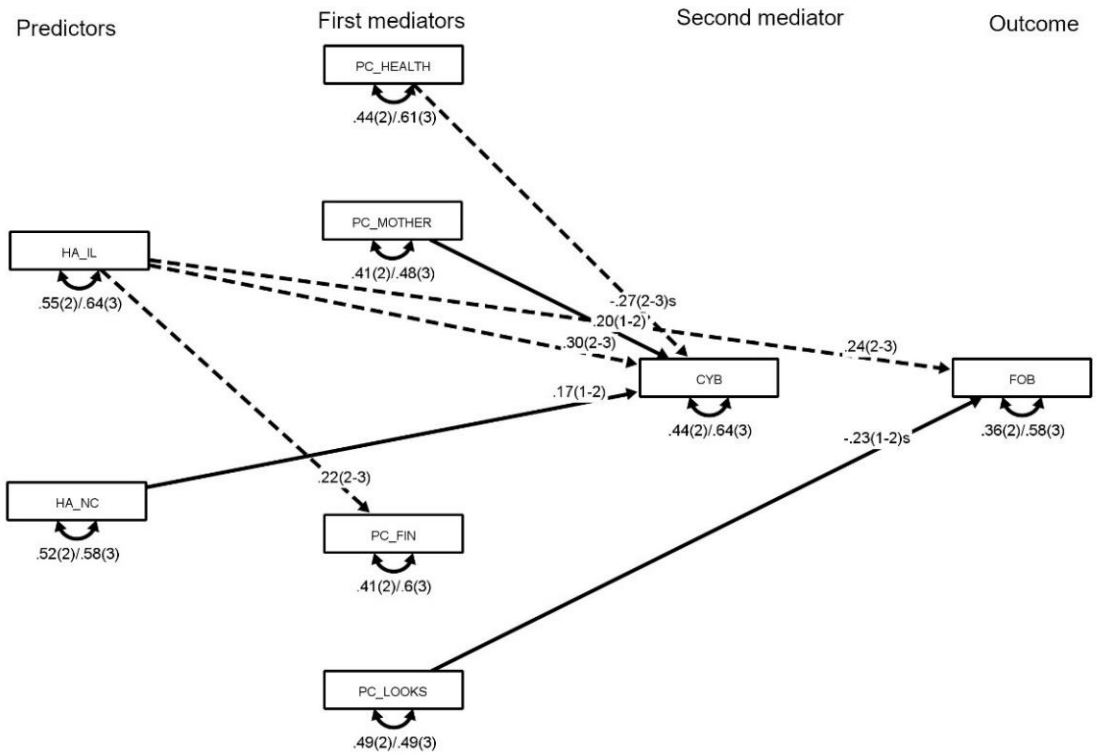
*** $p < .001$. * $p < .05$.

Concerning the model with anxiety sensitivity as a predictor, including lag-2 autoregression, the mediation regressions and the reciprocal regressions significantly improved the fit (Table 5). Therefore, the reciprocal model was chosen as the best (Figure 1b).

Figure 1

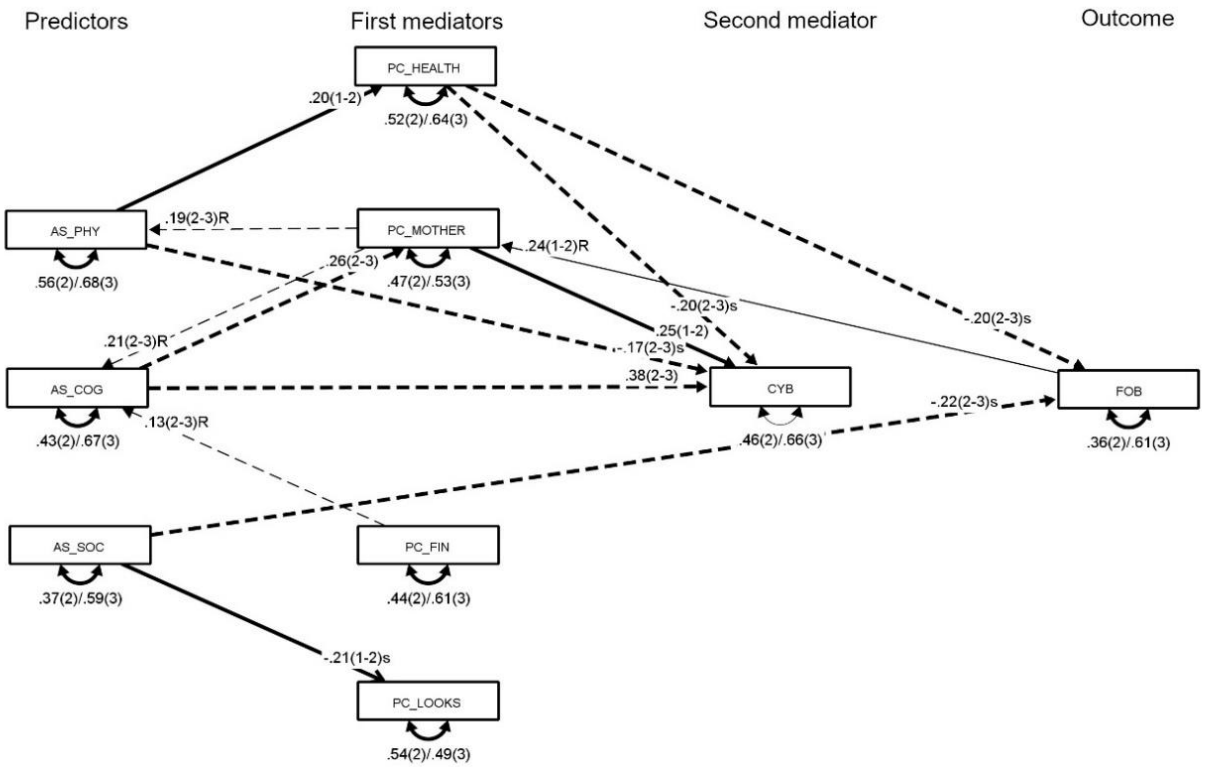
Cross lagged models of sequential mediation: health anxiety (a) / anxiety sensitivity (b)

(a)



Only paths significant at $p < .05$ and standardized loadings are displayed. Thick lines represent expected regressions, and thin ones reciprocal (R). Full lines represent paths from first to second time point (1-2), and dashed lines paths from second to third (2-3). Variance explained in each variable is shown below it for the second (2)/third (3) time point. Suppressor paths are marked by s.
HA = Health Anxiety: Illness Likelihood (IL), Negative Consequences (NC); AS = Anxiety Sensitivity: Physical (PHY), Cognitive (COG), Social Concerns (SOC); PC = Pregnancy Concerns: Health (HEALTH), Motherhood (MOTHER), Financial (FIN), Concerns about Looks (LOOKS); CYB = Cyberchondria; FOB = Fear of Birth.

(b)



Only paths significant at $p < .05$ and standardized loadings are displayed. Thick lines represent expected regressions, and thin ones reciprocal (R). Full lines represent paths from first to second time point (1-2), and dashed lines paths from second to third (2-3). Variance explained in each variable is shown below it for the second (2)/third (3) time point. Suppressor paths are marked by s.
HA = Health Anxiety: Illness Likelihood (IL), Negative Consequences (NC); AS = Anxiety Sensitivity: Physical (PHY), Cognitive (COG), Social Concerns (SOC); PC = Pregnancy Concerns: Health (HEALTH), Motherhood (MOTHER), Financial (FIN), Concerns about Looks (LOOKS); CYB = Cyberchondria; FOB = Fear of Birth.

When looking at both models, we can see that cyberchondria was consistently explained by motherhood related concerns and also by both dimensions of health anxiety and cognitive anxiety sensitivity. Cyberchondria did not predict fear of birth independently, which was explained only by health anxiety (illness likelihood). As for pregnancy specific concerns, they were mostly related to anxiety sensitivity (health, motherhood and financial concerns to physical and cognitive anxiety sensitivity), with the exception of financial concerns predicted by health anxiety (illness likelihood) and motherhood concerns predicted by fear of birth. Suppression effects, indicated by a negative regression coefficient in cases where bivariate correlations were positive or insignificant, were not interpreted due to their indeterminacy.

For most of these variables, about third to half of the variance was explained (R^2 = .35 - .67). However, most of the regression effects were small (|β| = .13 - .38), and a large part of the variance was explained by autoregressions from the same variable (Appendix 2).

Discussion

This study aimed to investigate cyberchondria in pregnant women, exploring its risk factors, triggers, and outcomes. Research hypotheses were partially confirmed and several significant findings emerged. We found that health anxiety and anxiety sensitivity were risk factors for cyberchondria, and pregnancy-specific anxiety acted as a trigger for this phenomenon. However, we did not find evidence to support fear of birth as an outcome of cyberchondria.

Pregnancy often brings heightened anxiety, leading women to rely on the Internet for health information (Prescott & Mackie, 2017). According to cognitive-behavioral models of cyberchondria, previous health experiences contribute to the formation of health beliefs and make some people more prone for development of cyberchondria (Brown et al., 2020; Schenkel et al., 2021). Our findings confirm that health anxiety and anxiety sensitivity are stable traits that contribute to the development of cyberchondria. However, these constructs are distinct (Schenkel et al., 2021), they play different roles in predicting cyberchondria and fear of birth in pregnant women. Health-anxious individuals perceive their health as vulnerable and tend to misinterpret physiological symptoms in a threatening manner (Marcus et al., 2007). Our results show that pregnant women who are health-anxious will be more prone to cyberchondria. Those women probably hope that they will be able to prevent future illness by gathering information. Consequently, they engage in online searches to alleviate

their concerns, which leads to a cycle of increased distress and compulsive research (Schenkel et al., 2021). Notably, this relationship is not necessarily triggered by current health circumstances, such as pregnancy, suggesting that health anxiety plays a broader role in driving cyberchondria.

Additionally, our research highlighted anxiety sensitivity, specifically its cognitive component, as another risk factor for cyberchondria. This finding is consistent with previous research (Fergus, 2015). Anxiety-sensitive individuals have more specific worries regarding the negative consequences of experiencing anxiety symptoms (Schenkel et al., 2021). Pregnant women who worry about the physical consequences of anxiety symptoms tend to have heightened concerns about their own health and the health of their baby, which supports findings that physical anxiety sensitivity contributes to health worries (Fergus, 2015). Interestingly, we found that women who express concerns about the cognitive consequences of anxiety, such as worries about their psychological well-being, concentration, and control over thoughts, experience increased concerns about motherhood and cyberchondria during late pregnancy. In this case, the current health circumstances, namely pregnancy, act as triggers for cyberchondria. It appears that women who are worried about their psychological functioning are also more likely to be concerned about handling childbirth and postpartum period (Badaoui et al., 2019). Moreover, those concerned with motherhood will tend to search for health information online and may develop cyberchondria. Anxious and neurotic women often lack confidence in their parenting abilities and may feel ill-equipped to adequately care for their babies (Klabbers et al., 2016) which may result in excessive online research. Our findings shed light on the specific topics that pregnant women tend to search for online. We observed that pregnancy concerns related to motherhood, such as postpartum issues, were particularly significant for cyberchondria. This suggests that women may focus more on potential future health concerns rather than current symptoms during pregnancy.

Although fear of birth was not identified as an outcome of cyberchondria, positive correlation between cyberchondria and fear of birth was found. This suggests that women who engage in excessive online research are also more likely to have higher levels of fear of birth. Based on our models, it can be concluded that women who are more health-anxious also worry more about childbirth. Health-anxious women view their health as vulnerable and impaired, making them more prone to belief that birth is a dangerous medical event that can have terrifying effects on health (Kowalyk, 2006).

Conclusion

This study represents the first comprehensive exploration of cyberchondria in pregnant women. Findings emphasize targeted interventions for birth-related fears in women with health anxiety. Interventions targeting cyberchondria should prioritize women experiencing health anxiety and cognitive anxiety sensitivity. Special attention should be given to women with heightened anxieties surrounding motherhood and postpartum, as our study reveals that these concerns act as triggers for cyberchondria. It is worth considering that these women may continue excessive online health research after giving birth, as one study suggests (Rathbone & Prescott, 2019). While the healthcare system typically provides enough information during pregnancy, it tends to overlook the postpartum period, which causes some women to seek information online (Ghiasi, 2021). Consequently, guidance on post-childbirth recovery and motherhood may be insufficient. The healthcare system primarily prioritizes the physical health of women, often overlooking the mother's overall well-being. Healthcare professionals should provide post-childbirth guidance, to mitigate the adverse effects of online health searches.

It is important to acknowledge research limitations, including online data collection, participant self-selection, small sample size, and sample non-representativeness. These factors may impact validity and generalizability of findings.

General discussion

The objective of this doctoral thesis has been to investigate the impact of the Internet on the psychological well-being of pregnant women, with a specific focus on the development and maintenance of psychological difficulties and childbirth-related fears, particularly in the context of cyberchondria. In an era marked by the widespread utilization of online resources for accessing health-related information, a growing number of individuals, including expectant mothers, are increasingly reliant on digital technology (Gui et al., 2017). This emerging trend has created an opportunity for exploration, particularly given the inclination of pregnant women toward seeking health information online (Prescott & Mackie, 2017). This leads them to potentially heightened anxieties and, at times, further into the circle of cyberchondria (Lagan et al., 2011a).

This research focus is particularly noteworthy considering the heightened vulnerability of pregnant women to anxiety and fear associated with childbirth, which significantly impact maternal mental health (Anniverno et al., 2013; Arch, 2013). While maternal health in the digital age has become a subject of increasing concern, the precise interplay between online information-seeking, cyberchondria, maternal anxieties, and fear of childbirth has not been comprehensively understood until now. The questions driving this thesis have been addressed through a multifaceted approach, encompassing both a comprehensive literature review and quantitative research methods. These methods involved the examination of correlations between variables and the exploration of long-term trends, thereby providing a good understanding of the dynamics among online health research, cyberchondria, and anxiety in pregnant women.

The primary objective of the first paper was to review the existing literature on the phenomenon of pregnant women seeking health-related information on the Internet. This review establishes a broad context for our exploration of cyberchondria in pregnant women. Today, pregnant women have many sources available that can provide answers to their questions on pregnancy. It is worth noting that the use of the Internet is a significant aspect of daily life for pregnant women, offering a place to address their queries about pregnancy. Within this context, we examined the most used sources for health information and assessed their reliability. Our findings indicated that women primarily rely on gynecologists for gathering information about pregnancy and health, followed by the internet and mobile applications. Paradoxically, while they frequently use the internet, they perceive it, along with mobile applications as the least reliable source, while the gynecologists are perceived as the

most reliable source of information. This duality in trust and usage underscores the paradox that pregnant women don't always consider the internet a trustworthy source of pregnancy-related information, yet they often resort to it (see Appendix 4a and 4b), which can lead to confusion and health concerns.

The reasons for pregnant women's engagement in internet searches on health-related topics were described in the initial part of this thesis. Common motivations include the speed of information acquisition, the desire for privacy and anonymity, the availability of vast information resources, and the use of simple terminology related to pregnancy (Lowe et al., 2009; Prescott & Mackie, 2017; Taheri et al., 2018; Tang & Lee, 2006). Additionally, women reported experiencing fewer negative assessments from online users compared to in-person interactions with healthcare providers or loved ones (Walther & Boyd, 2002). These findings are consistent with the psychological and sociological aspects of online communication, supporting our findings.

Furthermore, this paper provides a comprehensive overview of both the facilitating and inhibiting factors that prompt pregnant women to engage in internet health research. It also explores the processes within the healthcare system that encourage such searches. Our overview suggests that pregnant women are more likely to engage in online health research when they receive encouragement from medical professionals or close acquaintances, feel inadequately informed, or are motivated by curiosity (Taheri et al., 2018). Additionally, factors within the healthcare system, such as the frequency and duration of medical check-ups, drive pregnant women to seek information online as they aim to be well-prepared with questions for their medical appointments (Kraschnewski et al., 2014; Lagan et al., 2010, 2011b). It's noteworthy that women often look for additional details online after discussions during their check-ups (De Santis et al., 2010). This part underscores the significance of understanding why pregnant women turn to the internet for health information and serves as a context for the following parts of the thesis.

The review emphasizes the notable prevalence of pregnant women who turn to the internet for health-related information, with a considerable amount of time dedicated to this activity on a daily or weekly basis. Our study delved into the frequency of internet use for health-related research among pregnant women (see Appendix 4c, 4d, 4e). A majority of the women in our sample reported using the internet multiple times a week or even daily to seek information on pregnancy and health. Furthermore, most of them spent less than an hour a

day conducting health-related online searches. Intriguingly, our findings revealed that pregnant women tend to utilize the internet more frequently for health information during pregnancy compared to the period before their pregnancy. These findings are consistent with prior research before (Almoajel & Almarqabi, 2016; Bjelke et al., 2016; Larsson, 2009), collectively demonstrating the commonality of health-related internet research during pregnancy and the importance of research in this field.

Our review also outlined the primary sources used by pregnant women for health-related internet searches and the prevalent topics of interest. These sources include internet search engines, specific webpages, forums, blogs, social networks, and mobile applications (Almoajel & Almarqabi, 2016; Bert et al., 2013; Lagan et al., 2011b). Notably, fetal development emerges as the most frequently explored topic (Bert et al., 2013). The topics of interest, however, can vary depending on the trimester and the parity of the pregnancy (Bert et al., 2013; Gui et al., 2017; Kamali et al., 2018), underscoring the variety of sources and topics that can lead to compulsive internet research and anxiety as an outcome, which will be further studied in other parts of the thesis.

Furthermore, the review discussed various aspects related to the reliability of health information available on the internet for pregnant women. It also delved into the factors considered when evaluating the accuracy and relevance of such information. It's worth noting that studies have produced conflicting results regarding whether pregnant women discuss the information they find online with healthcare professionals overseeing their pregnancies. Our data revealed that a significant proportion of women in our sample either never or rarely engaged in discussions with their gynecologists about information obtained online (see Appendix 4f). This finding raises the potential for maintaining elevated levels of anxiety and uncertainty among some pregnant women.

The second part of this paper transitioned into an overview of the demographic, obstetric, and psychological characteristics that render pregnant women more inclined toward internet searches for health-related information. This section provided essential context for exploring potential predictors, triggers, and outcomes of cyberchondria in the subsequent parts of this thesis. Psychological attributes examined included health literacy, self-efficacy, health-related locus of control, health anxiety, and pregnancy-specific anxiety. Additionally, the section addressed the effects and consequences of internet searches on the well-being and

functioning of pregnant women, with particular attention given to compulsive web searches and heightened anxiety after searching.

This synthesis of knowledge within the review phase laid the conceptual groundwork for formulating hypotheses in subsequent empirical investigations. Emphasis was placed on anxiety, obstetric variables, and the impacts of online health research. In conclusion, this section underlines that internet usage is an integral part of everyday life for pregnant women. It highlights the necessity for further research regarding the online behaviors of pregnant women and the effects the internet has on their health and well-being. Although some psychological characteristics in pregnant women have been correlated with increased internet use, a comprehensive understanding of the mechanisms contributing to feelings of anxiety in pregnant women following online searches is yet to be fully explained. Consequently, this part of the thesis provided a base for the subsequent section, which connects psychological and obstetric variables to online health research, with the aim of achieving a clearer understanding.

The second part of this thesis aimed to examine the predictors of cyberchondria, also focusing on differences in cyberchondria severity and anxiety levels among pregnant women based on relevant obstetric variables discussed in the first part of the thesis. In this part, the key obstetric variable was the presence of medical complications in the current pregnancy. We explained our findings through the models of cyberchondria (Starcevic & Berle, 2013), the cognitive-behavioral model of health anxiety (Schenkel et al., 2021) and the model of information seeking in pregnancy (Das, 2013).

Our results revealed that pregnant women facing complications in their current pregnancy tend to exhibit higher levels of cyberchondria compared to those without pregnancy complications. Women facing medically complex pregnancies often report higher anxiety symptom levels than those with uncomplicated pregnancies (Abrar et al., 2020). This heightened anxiety is often due to the stress associated with medical management, frequent hospitalizations, feelings of lack of control, and worries about the fetus (Abrar et al., 2020). These women are more likely to seek health information online as part of their efforts to stay well-informed and make decisions regarding their health and their baby's. To sum up, they turn to online health research because they want to alleviate their concerns. However, this tendency to engage in continuous online searches on the same topic can lead to heightened

anxiety, ultimately contributing to the development of cyberchondria, aligning with the model of cyberchondria (Starcevic & Berle, 2013).

Consistent with the cognitive-behavioral model of health anxiety, frequent medical check-ups provide temporary relief from anxiety but may perpetuate health concerns since individuals continually seek reassurance when their fears resurface (Schenkel et al., 2021). Online health research introduces unpredictability in the outcomes of reassurance-seeking behaviors, which can result in the development of cyberchondria (Bagarić & Jokić-Begić, 2019). Furthermore, the vast array of online health information can be overwhelming and may contain unsettling details, sometimes intensifying anxiety more than before the research (Bagarić and Jokić-Begić 2019; Starcevic, Berle, and Arnáez 2020). Women experiencing complications during pregnancy often find themselves obligated to attend multiple medical appointments and examinations. This ongoing focus on their own health and that of their baby frequently leads to a predominantly health-oriented perspective of pregnancy. This shift in perspective can significantly contribute to heightened health anxiety (Kowalyk et al., 2009).

We also explored differences in cyberchondria based on complications in previous pregnancies and parity. In our sample, we did not find the difference in the severity of cyberchondria between women who had complications in their previous pregnancy and those who did not. For women with a current, uncomplicated pregnancy, there may be less need to spend significant time on internet health research. On the other hand, if there are any indications of complications in the current pregnancy, having prior experience from a complicated pregnancy, women may opt for discussions with medical professionals or close relatives rather than going online. As a result, the likelihood of cyberchondria occurring in this group is reduced (Starcevic & Berle, 2013). Our findings align with a study suggesting that pregnant women who experienced complications in a previous pregnancy often turn to online communities for emotional support during subsequent pregnancies, rather than primarily seeking health-related information (Rillstone & Hutchinson, 2001).

Interestingly, women who are pregnant for the first time do not exhibit higher levels of cyberchondria compared to those who have previously given birth. This finding suggests that both primiparous and multiparous women may engage in online health information seeking, and both groups are equally susceptible to developing cyberchondria, albeit for different reasons. For primiparous women, cyberchondria may arise due to the entirely new experience of pregnancy, prompting them to search for health information online to address their

uncertainties. In contrast, multiparous women may experience similarities between their current pregnancy and previous ones. If they encountered serious health issues in a prior pregnancy, this could make them particularly cautious during subsequent pregnancies, motivating them to seek health information online. Moreover, each pregnancy is unique and may introduce new experiences not encountered in previous pregnancies. Therefore, multiparous women, despite their experience with pregnancy and childbirth, may also turn to the internet to find health information, potentially leading to cyberchondria. One study found no correlation between health anxiety and parity in pregnant women or between health anxiety and complications in previous pregnancies (Kowalyk et al., 2009). This part of the thesis underscores the significance of obstetric characteristics that are often linked to online health research, as detailed in the first part of the thesis. It provides clear evidence that, in the context of excessive online health research, only complications in the current pregnancy warrant attention, as women facing complications have a higher likelihood of experiencing cyberchondria.

The second section of this paper was dedicated to unraveling the predictors of cyberchondria. For these analyses, we divided our sample into two groups: women with medically complicated pregnancies and those with medically uncomplicated pregnancies. The separation was essential because we identified notable differences in the severity of cyberchondria between these groups. Building upon the findings in our first paper, we also explored the significance of certain demographic and obstetric variables in the context of online health research. Specifically, we examined age and education as demographic characteristics and parity as a key obstetric variable. Our analysis revealed that none of these variables emerged as significant predictors of cyberchondria within our sample. In our final models, two crucial factors stood out as predictors of cyberchondria: health anxiety and pregnancy-specific anxiety. However, these factors played distinct roles depending on whether complications were present. Also, pregnancy-specific anxiety predicted cyberchondria in both groups, above health anxiety. For women with medically uncomplicated pregnancies, the interplay of health anxiety and pregnancy-specific anxiety emerged as predictors of cyberchondria. In contrast, in women facing medically complicated pregnancies we found that pregnancy-specific anxiety alone played the most prominent role in the development of cyberchondria.

According to the models of information seeking (Das, 2013; Wilson, 1997), specific information needs, an individual's direct experience with pregnancy complications and their

perceived health risks all contribute to the likelihood of seeking health information. In the case of women with medically complicated pregnancies, their heightened need for both health and pregnancy-related information becomes a strong motivator for engaging in information-seeking behaviors. These women tend to possess more focused information needs, actively seeking pregnancy-complication related information, leading to a more pregnancy-focused form of anxiety. Their perception of health risks is notably stronger. Consequently, their health anxiety tends to manifest through more pregnancy-specific concerns during online research, emerging pregnancy-specific anxiety as the sole predictor of cyberchondria within this group. In contrast, for women without pregnancy complications, the landscape of information seeking is different. In this group, there's typically a broader and less constrained approach to seeking health information. Pregnant women without complications may engage in a wider exploration of general health information. Their concerns about health, pregnancy, and symptoms often take a more hypothetical and less focused form.

This section of the thesis provides valuable insights into the predictors of cyberchondria and sheds light on the interplay of health anxiety and pregnancy-specific anxiety. Furthermore, it underscores the significance of considering complications in the context of online health research. All of the aforementioned observations strongly support the notion that both pregnancy-specific and health anxiety play vital roles in the development of cyberchondria among pregnant women. Our study provides substantial evidence that pregnancy-specific anxiety could serve as a mediator in the relationship between health anxiety and cyberchondria. This finding will be further explored and validated in the third part of our thesis, using a longitudinal research design, and examining how pregnancy-specific anxiety may act as a bridge between an individual's general anxiety and the manifestation of cyberchondria.

The objective of the third part of this thesis was to investigate the risk factors, triggers, and outcomes of cyberchondria in pregnant women. Additionally, we explored the stability of cyberchondria, anxiety, and fear of childbirth throughout pregnancy, collecting data in the early, mid, and late stages. This section aims to enhance our understanding of the mechanisms connecting these psychological variables, providing insights into their influence on the online health information-seeking behaviors of pregnant women.

Our analyses revealed no significant changes across three time points in most variables: health anxiety, anxiety sensitivity, cyberchondria, and the four dimensions of

pregnancy-specific anxiety (worries about health, finance, social relations, and looks). These findings align with the theoretical concept that health anxiety and anxiety sensitivity are stable trait characteristics. An intriguing discovery is the stability of cyberchondria levels during pregnancy, indicating that certain women consistently experience higher levels of cyberchondria throughout this period. It's plausible that these women have a predisposition to develop it, given their inclination to seek information throughout the entire pregnancy. However, their specific topics of interest in health information may vary depending on the trimester. In the first trimester, they actively seek information to confirm the conception of a child and closely monitor symptoms indicating the well-being of the pregnancy. In the second trimester, their focus shifts to ambiguous symptoms that might suggest complications, information about the child's movements, and self-care information. The third trimester is oriented toward preparations for delivery, with a concentrated need for information on that topic as well as motherhood (Gui et al., 2017). Consequently, some women consistently exhibit a tendency to address health concerns through online searches. It would be interesting to investigate whether these women also engaged in more frequent health information searches before pregnancy and whether this pattern continues post-birth.

Furthermore, for the four dimensions of pregnancy-specific anxiety (worries about health, finance, social relations, and looks), we did not observe differences depending on the trimester. Previous research has consistently shown that all components of pregnancy-specific anxiety, except for fear of childbirth, remain stable during pregnancy (Madhavanprabhakaran et al., 2015; Matthey & Souter, 2019; Rothenberger et al., 2011). Additionally, concerns about social relationships tend to be stable during pregnancy, reflecting women's satisfaction or dissatisfaction with their relations (Green et al., 2003). The same stability applies to concerns about looks and finances (Huizink et al., 2004; Rothenberger et al., 2011). The notion of stable health worries during pregnancy was discussed earlier in this discussion.

However, we did find differences in one dimension of pregnancy-specific anxiety (worries about motherhood) depending on pregnancy period. The motherhood-related concerns were lower in the first trimester compared to the second and third, with no difference between the second and third. Consistent with another study, these concerns tend to increase from the first to the second trimester and then remain stable in the third trimester (van Bussel et al., 2009). Notably, worries about motherhood are unique in their focus on the future, encompassing aspects like motherhood skills, birth, and breastfeeding. For pregnant women, these concerns introduce something new, perhaps unpredictable, leading to feelings

of uncertainty and worry. Additionally, our factor of motherhood worries includes concerns about childbirth, which also appeared to be unstable during pregnancy in our sample. Worries about breastfeeding and taking care of the baby are higher in the third trimester compared to the first (Madhavanprabhakaran et al., 2015). Women in the first trimester may not be as focused on these worries, as their attention is more directed toward the beginning of pregnancy and its preservation (Gui et al., 2017). As the reality of motherhood approaches, they become more concerned about this aspect.

Moreover, we observed changes in the fear of birth based on the pregnancy period. No changes in fear of birth were found between the first and second trimester, nor second and third trimester. However, fear of birth was lower in the first trimester compared to the third. This aligns with previous findings suggesting that fear of birth tends to increase during pregnancy, being milder in early compared to late pregnancy (Bhagwanani et al., 1997; Richens et al., 2018; Rofé et al., 1993; Rothenberger et al., 2011; Rouhe et al., 2009; Waldenström et al., 2006). In one study, all women reported a higher level of fear of birth compared to other components of pregnancy worries in the third trimester (Madhavanprabhakaran et al., 2015). A substantial 93% of women had very high fear of birth in the third trimester, while only 42% had high fear of birth in the first trimester (Madhavanprabhakaran et al., 2015). As childbirth approaches, women tend to think about it more, viewing it as the end of pregnancy and the beginning of a new phase. Therefore, it is expected that their fear is higher in the last part of pregnancy compared to the first part.

In this section of the thesis, our focus was also on investigating the risk factors, triggers, and consequences of cyberchondria. Building on insights from the second part of the thesis, we established that both health anxiety and pregnancy-specific anxiety play predictive roles in cyberchondria. Notably, pregnancy-specific anxiety emerged as a significant predictor, indicating potential mediation. This aspect was further examined in the current section through the inclusion of a longitudinal study design. Our results highlight that cyberchondria is influenced by concerns related to motherhood, as well as by health anxiety and cognitive anxiety sensitivity and are in line with cognitive-behavioral models of cyberchondria (Brown et al., 2020; Schenkel et al., 2021).

Our findings affirm that health anxiety and anxiety sensitivity are enduring traits contributing to the development of cyberchondria. Individuals with health anxiety perceive their well-being as vulnerable and often misinterpret physiological symptoms, fostering a

cycle of distress and compulsive online research (Marcus et al., 2007; Schenkel et al., 2021). Importantly, this relationship isn't necessarily triggered by current circumstances, such as pregnancy, underscoring the broader role of health anxiety in driving cyberchondria.

Furthermore, our research spotlights anxiety sensitivity, particularly its cognitive component, as another risk factor for cyberchondria, aligning with prior studies (Fergus, 2015). Women expressing concerns about the cognitive consequences of anxiety exhibit heightened concerns about motherhood and cyberchondria. Here, the current health circumstance, pregnancy, serves as a trigger for cyberchondria. Women apprehensive about their psychological functioning are more likely to be concerned about managing childbirth and the postpartum period (Badaoui et al., 2019). This group, anxious about motherhood, tends to seek health information online, potentially leading to the development of cyberchondria. In the first part of the thesis, we delineated pregnant women's expressed desires for additional information regarding self-care and childcare during pregnancy. Their curiosity extended to understanding the breastfeeding process, achieving a smoother and quicker recovery after childbirth, and postpartum health, driven by a perceived lack of knowledge in these domains (Grimes et al., 2014). Notably, these findings align with our own observations. Furthermore, pregnant women conveyed a preference for information that not only centered on the child but also aimed at enhancing their competencies as prospective parents (Hearn et al., 2013). This underscores a broader need for knowledge that encompasses the entire spectrum of parenthood. Additionally, women reported the desire for learning from experts who not only provide information but also extend support and recognize the women's need for information (Singh et al., 2002). These collective insights parallel our own research, emphasizing the multifaceted nature of information-seeking behavior during pregnancy.

While fear of birth wasn't identified as a direct outcome of cyberchondria, a positive correlation between cyberchondria and fear of birth emerged. This implies that women engaging in excessive online research are more likely to experience heightened fear of childbirth. An abundance of online information, combined with a lack of understanding or insufficient knowledge regarding the birth process in women, along with conflicting information online, has the potential to heighten fear of childbirth (Sheen & Slade, 2018). However, it's notable that women with higher levels of health anxiety also tend to worry more about childbirth. Elevated somatic anxiety and lower stress tolerance are associated with higher levels of fear of childbirth (Ryding et al., 2007).

In this thesis's concluding segment, we dissect the themes guiding pregnant women's online explorations. Notably, concerns linked to motherhood, especially those surrounding postpartum issues, emerge as significant contributors to cyberchondria. Our analysis underscores the pivotal role of health anxiety and the cognitive facet of anxiety sensitivity as core risk factors intertwined with cyberchondria during pregnancy. Motherhood-related concerns act as crucial triggers in this complex interplay.

Collectively, these papers contribute to a comprehensive understanding of the complex relationship between pregnancy, anxiety, and online health research. The progression across these papers is integral in establishing a foundation of knowledge rooted in an extensive literature review. This review served as a base for hypotheses and theoretical frameworks that shaped subsequent investigations and culminated in insightful findings. Across the papers, a convergence emerges regarding the significance of anxiety - health anxiety, pregnancy-specific anxiety and anxiety sensitivity - as key factors influencing cyberchondria among pregnant women. Notably, this series of studies investigates the psychological aftermath of adverse pregnancy complications, an area often overlooked in existing research (Jia et al., 2023). By focusing on the impact of online health research specifically within the context of pregnancy and pregnancy complications, these papers address a critical gap in the field. Moreover, the second paper particularly highlights the relevance of complications in current pregnancies, shedding light on their direct correlation with cyberchondria. This brings forth a crucial understanding of the psychological implications of these complications and their interplay with the pursuit of online health information during pregnancy. The longitudinal research, featured in the third paper, serves as a pivotal investigation into the multifaceted aspects of cyberchondria. It examines not only the risk factors, triggers, and outcomes, but also the stability of cyberchondria levels across various stages of pregnancy. This longitudinal approach reinforces the significance of health and pregnancy-specific anxieties and unravels how these anxieties manifest and persist over time in relation to online health research. It incorporates all theoretical and research findings from previous papers, clarifying the story about cyberchondria in pregnancy.

These papers uniquely complement each other, as each builds upon the findings and insights of the preceding work. The initial literature review sets the stage, guiding the hypotheses and subsequent explorations. The second paper then drills deeper into the predictors of cyberchondria and psychological repercussions of complications during pregnancy, setting the groundwork for the third paper's comprehensive longitudinal study.

Together, these papers provide a holistic understanding of the complex relationship between pregnancy, online health research, and the emergence of cyberchondria. They offer a perspective that expands our understanding of how these factors relate and affect pregnant women, offering valuable insights for healthcare providers, researchers, and expecting mothers alike.

Limitations and strengths

The papers included in this thesis exhibit certain limitations that warrant consideration. The first paper, being a literature review, isn't subject to limitations commonly associated with empirical studies such as online data collection or participant selection. However, it's important to note that the conclusions drawn in a review paper are reliant on the available literature and can be influenced by the quality, breadth, and depth of the sources included.

In contrast, the empirical studies encountered several limitations. For instance, the second study, a one-measurement point correlational research, faced limitations due to the absence of pre-pregnancy anxiety data and a lack of obstetrical outcome information during the current pregnancies. This absence restricted the exploration of changes in psychological characteristics during pregnancy and understanding potential repercussions of cyberchondria for women.

However, the third paper, utilizing a longitudinal research design, provided insights into the stability of psychological constructs over pregnancy, allowing for a more in-depth exploration of potential causal relationships. Nevertheless, it faced challenges such as a relatively small sample size, attrition of participants, and difficulties in securing participation from private gynecologists to disseminate research invitations in their clinics.

Additionally, all studies were conducted online, which posed inherent limitations related to participant self-selection and non-representativeness of the sample. Self-selection occurred as questionnaires were filled out by women interested in the topic, motivated to answer questions, and associate themselves with the subject matter. Another limitation lies in the challenge of controlling participants' behaviors during online studies. Nevertheless, given the focus of this thesis on constructs shaped by technology interaction, conducting the research online appears to be a logical approach. However, despite these limitations, the

collective approach of employing diverse methodologies across the studies significantly contributed to mitigating the limitations associated with individual study designs.

Practical implications

This thesis offers several practical implications drawn from its findings. Women's increased reliance on online health research during pregnancy, while lacking communication with their doctors about such information, highlights a crucial gap. Encouraging doctors to initiate discussions during examinations about online health information could provide a safe environment for correcting misinformation and allaying anxieties. Obstetricians should be well-versed in recommending credible online sources and smartphone applications to expecting mothers while educating them on discerning reliable information sources. While educational discussions may suffice for some women, highly anxious individuals requiring more support should be advised to limit or stop online research. Moreover, involving physicians in creating online content for pregnant women, considering their expertise, could yield significant benefits.

Health-care providers should acknowledge the tendency for pregnant women, especially those facing complications, to seek online health information, and proactively address their concerns. Given that pregnancy complications can influence mental health, detailed discussions with affected women about these complications, their treatment, and potential consequences for both mother and child are extremely important. Early identification, prevention, and treatment of peripartum mental health issues in women facing complications could significantly improve pregnancy outcomes (Brown et al., 2018).

Additionally, acknowledging motherhood-related concerns as triggers for cyberchondria implies the need to include topics like childbirth, breastfeeding, and childcare in one-on-one discussions or prenatal courses for pregnant women. Post-childbirth guidance by healthcare professionals could mitigate adverse effects stemming from online health research. Integrating discussions about anxiety and cyberchondria into prenatal courses is also pivotal. Educating pregnant women about identifying signs of anxiety or cyberchondria and seeking professional help is essential.

Supporting the mental health of pregnant women in the digital age poses significant challenges. Educating healthcare staff about the specific characteristics that make women more prone to cyberchondria and pregnancy-related anxiety, along with its implications for

both women and children, is crucial. Leveraging support from families, friends, and professionals could substantially reduce anxiety and depression levels in pregnant women (Akdag Topal & Terzioglu, 2019; Fisher et al., 2012). Studies consistently highlight the protective role of social support against anxiety and depression during pregnancy (Friedman et al., 2020; Iwanowicz-Palus et al., 2021; Qu et al., 2021). Recognizing and integrating these supportive elements into healthcare practices can significantly benefit the mental well-being of pregnant women.

Implementing peer support groups, facilitated by mental health experts and physicians, could offer a valuable avenue for pregnant women to engage in open discussions. These groups could provide a supportive environment where concerns are normalized, offering a space for shared experiences and mutual understanding. Led by professionals, these groups could not only foster emotional support but also offer accurate and credible information, helping women navigate their concerns effectively while building a sense of solidarity and reassurance within the community.

Pregnancy often triggers health anxiety due to unfamiliar or peculiar bodily sensations, potentially leading to heightened concerns. This increased health anxiety can exert adverse effects on the course of pregnancy (Kowalyk et al., 2009). Anxiety can significantly impact a mother's psychological well-being, subsequently affecting her physical health. If left unaddressed, the cycle of anxiety during pregnancy can persist, yielding a consistent negative impact (Rathbone & Prescott, 2019). Consequently, women experiencing high health anxiety before pregnancy or facing concerns during pregnancy related to motherhood should remain vigilant. Seeking professional help is vital if negative consequences arise from online health research. Furthermore, our findings suggest a relationship between health anxiety and fear of birth, warranting targeted interventions for birth-related fears in women experiencing health anxiety. This approach aims to alleviate stress during childbirth, empowering women to feel more in control and potentially reducing the impact of their perception of childbirth as terrifying on their overall well-being.

Individual and group interventions aimed at addressing cyberchondria should prioritize women experiencing health anxiety and cognitive anxiety sensitivity. These interventions should emphasize coping strategies for future worries related to childbirth and the postpartum phase. Techniques focusing on relaxation, fostering positive imagination, and detailed preparation for childbirth play a pivotal role. Preparing for the role of motherhood,

envisioning potential challenges immediately after childbirth, and strategizing on how to navigate them are also essential, as well as strengthening social resources by identifying trustworthy individuals who can assist new mothers. Education on mindfulness, especially beneficial for those experiencing pregnancy complications, aids in being present and managing stressful situations. Encouraging women to prepare for challenging periods and equipping themselves with resources for them is invaluable for maintaining mental well-being during pregnancy and postpartum. These interventions cater to individual needs, fostering preparedness and resilience in confronting potential stressors.

Regarding women's engagement in online information about childbirth and the postpartum period, it's crucial to regulate excessive health-related internet searches during and after pregnancy. Practical guidance should be provided, directing women to reliable sites, instructing on effective search methods, and educating them about the internet's impact on mental health, especially when reading the personal experiences of other mothers. Training on appropriate online behavior, recognizing when to halt searches, and self-help techniques in case of distress during searches are essential. Additionally, women should be informed during pregnancy about childbirth and motherhood-related topics, gathering credible information to foster a sense of readiness and control over the situation. Encouragement to ease concerns and share hypothetical worries with trusted individuals helps to alleviate anxiety and prevent excessive online searches leading to cyberchondria. The goal is to empower women with adequate knowledge, enabling them to navigate pregnancy and the postpartum phase confidently without succumbing to excessive online health research.

The integration of mental health professionals, particularly psychologists, within the prenatal care system is pivotal for providing immediate support to pregnant women experiencing heightened anxiety levels. In many healthcare settings, including some hospitals in Croatia, the accessibility of mental health professionals during prenatal care and postpartum stages remains limited. Ensuring the availability of psychologists within the healthcare system is crucial to cater to the emotional well-being of pregnant women and new mothers. Offering easy access to psychological support as a standard part of prenatal care can aid in identifying and addressing anxiety-related concerns promptly, fostering mental well-being throughout the perinatal period.

Future directions

The cyberchondria in pregnant women remains an underexplored area warranting further investigation. A deeper understanding of the specific topics, processes, mechanisms, and methodologies surrounding internet usage that contribute to cyberchondria during pregnancy represents an intriguing avenue for future research. Employing qualitative and experimental research designs would be particularly valuable in exploring these topics. Understanding the ways individuals search for, process, and utilize online health information during pregnancy could provide insights into the factors leading to cyberchondria in expectant mothers. Examining the coping mechanisms pregnant women utilize in managing cyberchondria is crucial for comprehending effective interventions. Understanding the ways in which women navigate their anxieties, actively seek support networks, and process information sourced from online health research can unveil (mal)adaptive strategies. Understanding these coping mechanisms offers insights that can guide the development of supportive measures tailored to their specific needs.

Assessing the efficacy of programs designed to address cyberchondria during pregnancy is essential. Conducting evaluations on courses tailored to alleviate cyberchondria, incorporating psychoeducation and practical skills focusing on responsible online health research and methods to manage related anxieties, warrants investigation. These courses could serve as potential interventions and should be subject to testing to determine their effectiveness in reducing cyberchondria among pregnant women.

Examining the correlation between cyberchondria and healthcare utilization within the context of pregnant women presents an interesting topic for research. Understanding whether heightened anxiety arising from online health research influences doctor visits, unnecessary medical procedures, or alters decision-making in healthcare can highlight practical implications. Investigating the perceptions and experiences of doctors and obstetricians regarding the repercussions of cyberchondria can enrich our understanding of its impact. Moreover, identifying the challenges healthcare providers encounter when managing cyberchondria among pregnant women could inform collaborative interventions, fostering strategies that integrate healthcare professionals in mitigating the adverse effects of online health research during pregnancy.

Moreover, future research should focus on obstetric variables, psychological factors, and medical risk elements that could contribute to cyberchondria in all women, but especially

those with complications. Understanding variances in online behavior based on pregnancy outcomes, birth experiences, and different types of complications - whether obstetrical, maternal, or fetal - would offer valuable insights into the overall mechanism and consequences of cyberchondria. The nuanced differences in the manifestation of cyberchondria based on the severity and nature of complications could be explored extensively.

Anxiety during pregnancy has been linked to enduring effects on parenting. Studies suggest that such anxiety is associated with various facets of parental stress and diminished parental self-efficacy (Huizink et al., 2017). Women who worry during pregnancy continue to worry as parents and are more prone to parental stress (Huizink et al., 2017). Therefore, this anxiety may impede optimal preparation for parenthood (Wernand et al., 2014). Research is warranted to explore whether internet research during pregnancy contributes to this aspect, especially considering women's focus on motherhood-related concerns during their online searches. Additionally, investigating the specific worries pregnant women harbor regarding motherhood and how these concerns align with their engagement in online health research is essential. Examining the enduring effects of cyberchondria during pregnancy on the post-pregnancy period is crucial, encompassing psychological components such as health-related worries and behaviors, decision-making concerning parenthood, the development of parenting skills, and their relationships with significant others. Furthermore, longitudinal exploration of the continuation of online health research and the persistence of cyberchondria post-childbirth is necessary - examining the topics researched, the motivations behind the searches, and potential consequences.

Exploring the psychological mechanisms involved in online health research among women experiencing primary tokophobia is a critical area for further investigation. Understanding the ramifications of their internet searches, such as the potential decision to postpone pregnancy, choosing to remain childless, or persistently fretting about childbirth, children, and parenthood, necessitates thorough research. Assessing how their anxieties shape online health behavior and the subsequent outcomes is important in comprehending and supporting individuals dealing with primary tokophobia.

Although psychological aspects linked to medically assisted reproduction are currently under research, there's a gap in understanding its relationship with online health research and cyberchondria. With the rising prevalence of fertility issues among couples and the

consequential emotional distress, stigma, and financial challenges, investigating how individuals navigating this process engage in online health research is crucial (World Health Organization, 2023). Examining the potential influence of internet searches on their mental and psychosocial well-being amidst medically assisted reproduction could provide insights into addressing their concerns and offering adequate support.

Conclusion

In the digital age, the accessibility of health information online presents both advantages and significant mental health challenges for pregnant women. The impacts of online health research during pregnancy, especially in complicated pregnancies, have illuminated a critical area of concern for maternal mental health. Examining the dynamics of cyberchondria, our findings emphasize the effects of online world on the well-being of expectant mothers.

Reflecting on the extensive engagement of pregnant women in online health research, our study highlights the pervasive nature of this phenomenon. Throughout pregnancy, the digital world becomes a place for seeking reassurance, validating experiences, and obtaining health-related information. Considering the responsibility put on women regarding their pregnancy and childbirth, it is expected for them to engage in online research. Women have a strong desire for reassurance that what they are experiencing in their pregnancy is "normal" (Luce et al., 2016), especially if they are experiencing pregnancy complications.

Our comprehensive exploration brings to the fore a connection between pregnancy complications and the emergence of cyberchondria. Encountering complexities during pregnancy significantly amplifies health anxiety, pregnancy-specific anxiety, and ultimately fosters a milieu conducive to the intensification of cyberchondria. Diving into predictors and risk factors, our longitudinal study elucidates the pivotal role of health anxiety and cognitive anxiety sensitivity in fostering cyberchondria. Moreover, the identification of motherhood-related concerns as significant triggers further solidifies the multifaceted nature of this condition.

According to our findings, motherhood-related concerns can lead to cyberchondria. The Internet, surpassing all other media, creates a cultural ideal of a "good" mother (Luce et al., 2016), encompassing a narrative of flawless pregnancy and parenthood. This ideal perpetuates an unrealistic paradigm, fostering anxiety, intense pressure, and self-doubt among expectant mothers, steering them towards compulsive online searches. The discrepancy between the idealized portrayal of pregnancy and the reality experienced by women surfaces as a source of distress. The weight of societal expectations propels them into a pursuit of doing pregnancy "right", both online and offline, instigating feelings of inadequacy and evoking uncertainties regarding their feelings, decisions, and overall future parenthood (Luce et al., 2016).

In conclusion, our research underscores the implications of the digital landscape on maternal mental health, elucidating the interplay between psychological characteristics, medical complications, and the emergence of cyberchondria. Efforts to alleviate the effects of distressing online environment require targeted interventions, prioritizing support for women with pregnancy complications and those managing motherhood-related concerns. Understanding the facets of cyberchondria is crucial for medical and mental-health professionals to tailor targeted support and intervention strategies. Future interventions must pivot towards fostering an environment of reassurance and support, fortifying the mental resilience of expectant mothers amid the digital age. We should empower women to navigate pregnancy and motherhood in a supportive, reliable, and realistic online environment.

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Supplementary Material

Appendix 1

Mean levels of health anxiety, anxiety sensitivity, pregnancy concerns, cyberchondria and fear of birth across the three time points

Variable	Time point	*N*	ω_{tot}/α	*M* (*SD*)	Median	Friedman χ^2 (*p*)
HA IL	1	135	.86/ .86	0.7 (0.4)	0.6	.01
	2	97	.88/ .88	0.7 (0.4)	0.7	(.996)
	3	77	.87/ .86	0.7 (0.4)	0.7	
HA NC	1	128	.80/ .79	0.7 (0.6)	0.7	1.73
	2	95	.80/ .80	0.7 (0.5)	0.8	(.422)
	3	77	.79/ .79	0.7 (0.5)	0.5	
AS PHY	1	123	.89/ .88	0.8 (0.8)	0.5	4.22
	2	95	.89/ .89	0.8 (0.7)	0.5	(.121)
	3	77	.91/ .90	0.8 (0.8)	0.5	
AS COG	1	123	.91/ .91	0.6 (0.8)	0.3	1.53
	2	95	.89/ .89	0.6 (0.7)	0.3	(.465)
	3	77	.93/ .93	0.6 (0.8)	0.3	
AS SOC	1	123	.81/ .80	0.9 (0.8)	0.7	4.29
	2	95	.83/ .83	1.0 (0.7)	0.8	(.117)
	3	77	.88/ .88	1.1 (0.8)	0.8	
PC	1	149	.87/ .87	1.6 (0.7)	1.5	3.83
HEALTH	2	98	.88/ .88	1.5 (0.7)	1.3	(.148)
	3	77	.88/ .87	1.4 (0.7)	1.3	
PC	1	149	.70/ .70	0.9 (0.7)	1.0	7.14
MOTHER	2	98	.63/ .62	1.1 (0.7)	1.0	(.028)
	3	77	.73/ .73	1.2 (0.8)	1.0	
PC FIN	1	149	.74/ .74	0.9 (0.7)	0.5	2.70
	2	98	.80/ .80	1.0 (0.8)	0.8	(.26)
	3	77	.82/ .82	1.0 (0.9)	1.0	
PC SOC	1	148	.48/ .48	0.4 (0.5)	0.0	.22
	2	98	.55/ .55	0.5 (0.7)	0.0	(.894)

	3	77	.58/ .58	0.5 (0.7)	0.5	
PC	1	149	.82/ .82	0.6 (0.8)	0.5	.53
LOOKS	2	98	.72/ .72	0.6 (0.7)	0.5	(.767)
	3	77	.84/ .84	0.6 (0.7)	0.5	
CYB	1	141	.85/ .84	2.3 (1.0)	2.3	1.55
	2	98	.84/ .83	2.2 (0.8)	2.3	(.46)
	3	77	.88/ .87	2.4 (1.0)	2.3	
FOB	1	119	.89/ .89	0.5 (0.3)	0.5	7.64
	2	95	.95/ .95	0.5 (0.3)	0.5	(.022)
	3	76	.93/ .93	0.6 (0.3)	0.6	

Note. The theoretical range for HA and PC was 0-3, for AS 0-4, for CYB 1-5, and for FOB 0-1. HA = Short Health Anxiety Inventory dimensions: Illness Likelihood (IL) and Negative Consequences (NC); AS = Anxiety Sensitivity Index dimensions: Physical (PHY), Cognitive (COG), and Social Concerns (SOC); PC = Pregnancy Concerns Scale dimensions: Health (HEALTH), Motherhood (MOTHER), Financial (FIN), Social Relations Concerns (SOC), and Concerns about Looks (LOOKS); CYB = Short Cyberchondria Scale; FOB = Fear of Birth Scale.

Appendix 2

Standardized autoregression coefficients in the final cross lagged models

Model	Variable	Time points		
		2 - 1	3 - 2	3 - 1
Health anxiety as the predictor	HA IL	.74***	.55***	.30**
	HA NC	.72***	.52***	.29**
	PC HEALTH	.63***	.62***	.15
	PC MOTHER	.61***	.43***	.24*
	PC FIN	.65***	.57***	.17
	PC LOOKS	.70***	.21	.52***
	CYB	.54***	.25**	.41***
	FOB	.50***	.58***	.05
Anxiety sensitivity as the predictor	AS PHY	.71***	.39***	.36***
	AS COG	.58***	.38***	.39***
	AS SOC	.61***	.55***	.19*
	PC HEALTH	.50***	.69***	.09
	PC MOTHER	.51***	.38***	.29**
	PC FIN	.66***	.58***	.15
	PC LOOKS	.72***	.31*	.44**
	CYB	.61***	.24*	.43***
	FOB	.51***	.66***	.07

Note. HA = Short Health Anxiety Inventory dimensions: Illness Likelihood (IL) and Negative Consequences (NC); AS = Anxiety Sensitivity Index dimensions: Physical (PHY), Cognitive (COG), and Social Concerns (SOC); PC = Pregnancy Concerns Scale dimensions: Health (HEALTH), Motherhood (MOTHER), Financial (FIN), and Concerns about Looks (LOOKS); CYB = Short Cyberchondria Scale; FOB = Fear of Birth Scale. $^{***}p < .001$. $^{**}p < .01$. $^{*}p < .05$.

Appendix 3

Correlations between predictors, mediators and the outcome in the first (above the main diagonal, n = 118 - 149) and the second/third time point (below the diagonal, n = 94 - 98 for the second, and n = 76 - 77 for the third)

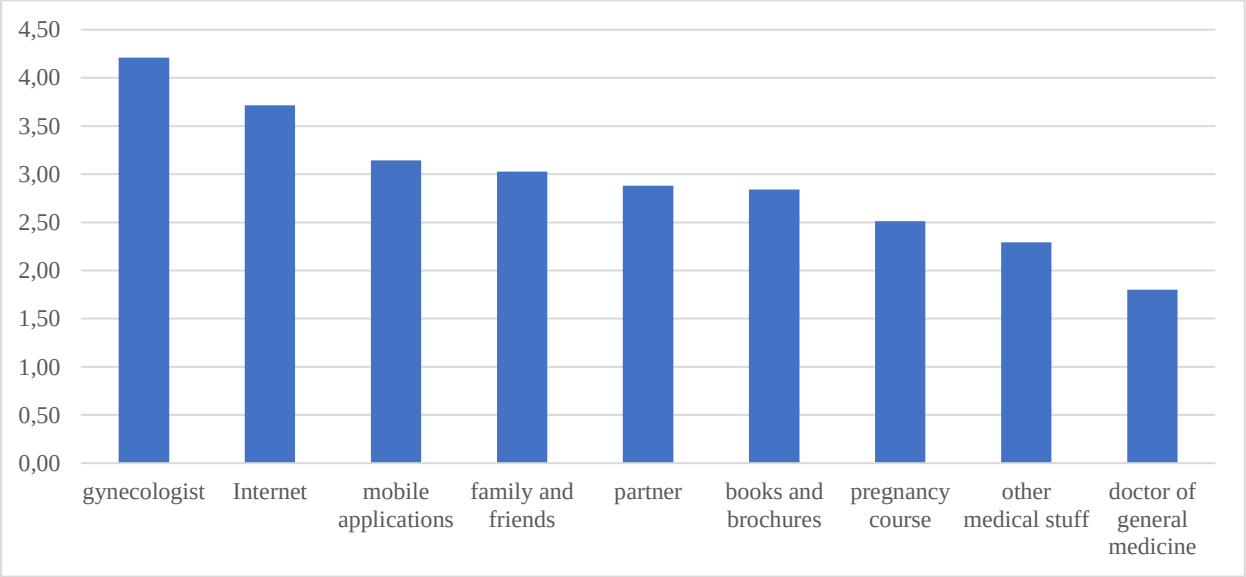
	Predictors					First mediator				Second mediator		Outcome	
Variables	HA IL	HA NC	AS PHY	AS COG	AS SOC	PC HEALTH	PC MOTHER	PC FIN	PC LOOKS	CYB	CYB +1	FOB	FOB +1
HA IL		.30***	.49***	.45***	.42***	.50***	.38***	.17*	.29***	.60***	.43***	.48***	.35***
HA NC	.34***/ .28*		.11	.27**	.33***	.21*	.22*	.14	.33***	.35***	.25*	.24**	.16
AS PHY	.44***/ .54***	.33**/ .35**		.56***	.41***	.29**	.12	.19*	.15	.34***	.18	.26**	.36***
AS COG	.49***/ .46***	.36***/ .31**	.57***/ .59***		.59***	.24**	.19*	.20*	.27**	.39***	.27**	.31***	.36***
AS SOC	.41***/ .34**	.30**/ .39***	.52***/ .51***	.57***/ .73***		.10	.30***	.20*	.44***	.31***	.28**	.22*	.19
PC HEALTH	.38***/ .43***	.08/ .13	.29**/ .45***	.26**/ .38***	.08/ .24*		.48***	.30**	.27**	.43***	.33***	.41***	.31**
PC MOTHER	.31**/ .40***	.21*/ .17	.28**/ .49***	.26*/ .47***	.16/ .29*	.50***/ .52***		.09	.52***	.26**	.34***	.59***	.34***
PC FIN	.01/ .12	.13/ .19	.05/ .31**	.12/ .32**	.09/ .30**	.42***/ .45***	.14/ .28*		.19*	.14	.04	.18	.23*
PC LOOKS	.34***/ .17	.2/ .29*	.12/ .17	.32**/ .21	.14/ .16	.30**/ .16	.35***/ .37**	.22* / .20		.20*	.22*	.35***	.12
CYB	.51***/ .50***	.31**/ .21	.26*/ .33**	.41***/ .34**	.26*/ .37***	.31**/ .37**	.33***/ .31**	.12/ .10	.23*/ .10		.61***	.38***	.34***

CYB+1	.51***/ —	.29*/ —	.28*/ —	.46***/ —	.44***/ —	.22/ —	.24*/ —	.07/ —	.10/ —	.62***/ —		.29**	.38***
FOB	.39***/ .43***	.22*/ .26*	.26*/ .51***	.37***/ .51***	.29**/ .35**	.41***/ .43***	.45***/ .60***	.20* / .21	.33**/ .17	.38***/ .46***	.41***/ —		.59***
FOB+1	.52***/ —	.26*/ —	.38**/ —	.45***/ —	.33**/ —	.34**/ —	.44***/ —	.16/ —	.29*/ —	.29*/ —	.46***/ —	.72***/ —	

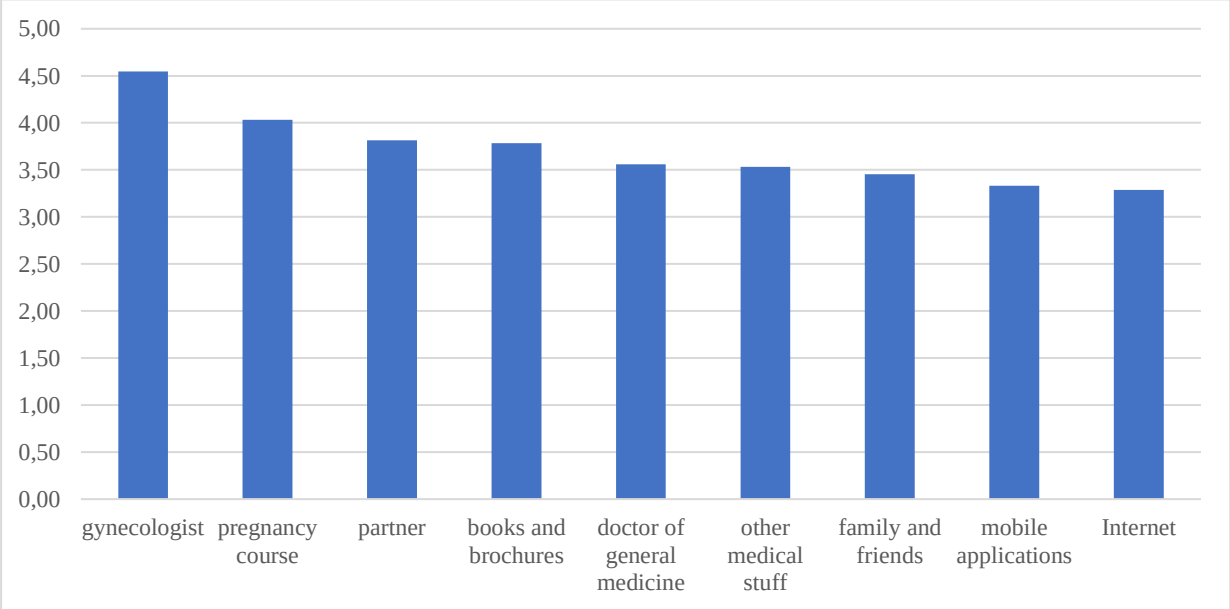
Note. HA = Short Health Anxiety Inventory dimensions: Illness Likelihood (IL) and Negative Consequences (NC); AS = Anxiety Sensitivity Index dimensions: Physical (PHY), Cognitive (COG), and Social Concerns (SOC); PC = Pregnancy Concerns Scale dimensions: Health (HEALTH), Motherhood (MOTHER), Financial (FIN), and Concerns about Looks (LOOKS); CYB = Short Cyberchondria Scale; FOB = Fear of Birth Scale; +1 = variable measured in the following time point,
$^{***}p < .001$. $^{**}p < .01$. $^{*}p < .05$.

Appendix 4

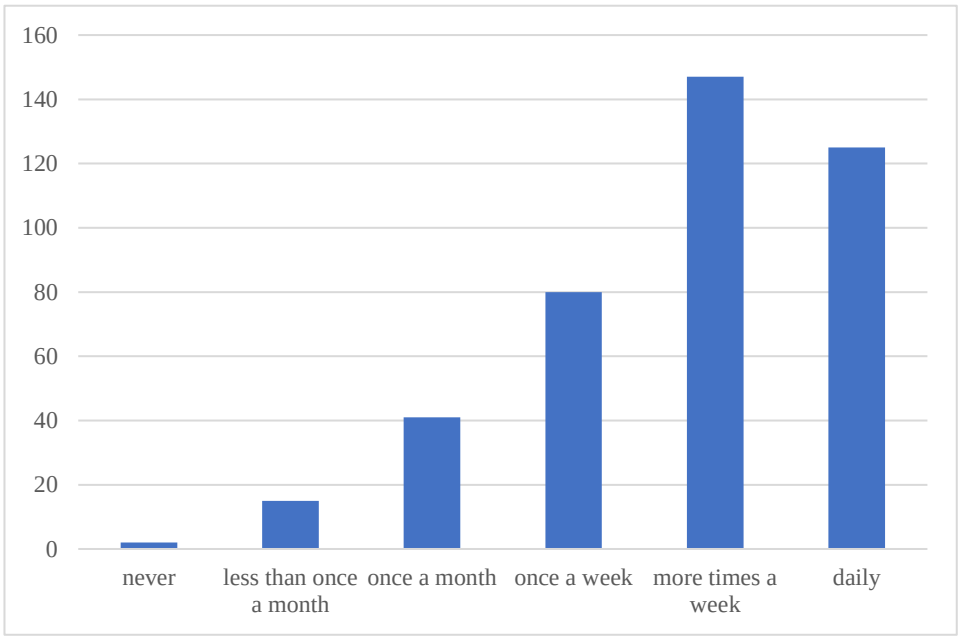
a) *The frequency of used sources for gathering pregnancy related information (n = 414)*



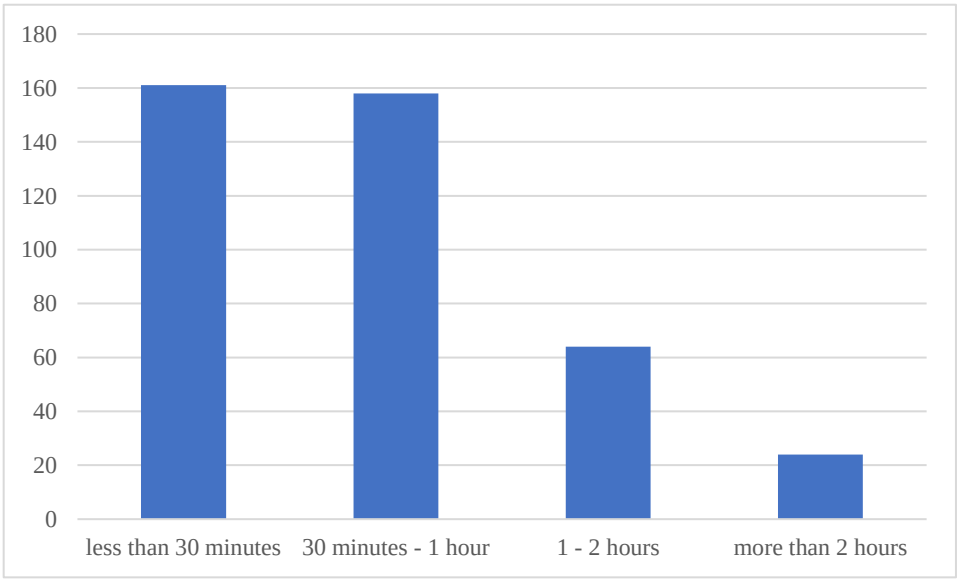
b) *The assessment of the reliability of the sources of information (n = 414)*



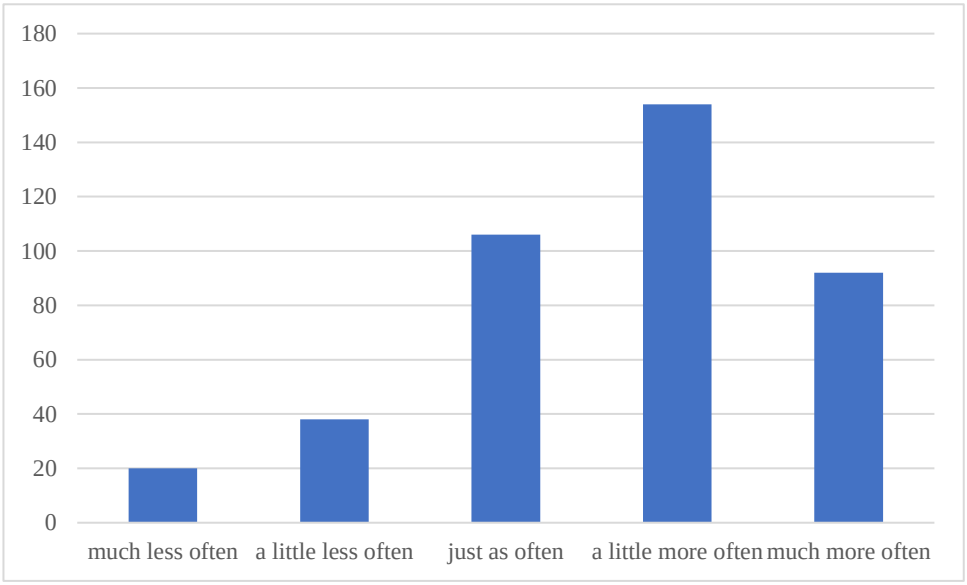
c) *The frequency of using the Internet for information about pregnancy and health (n = 410)*



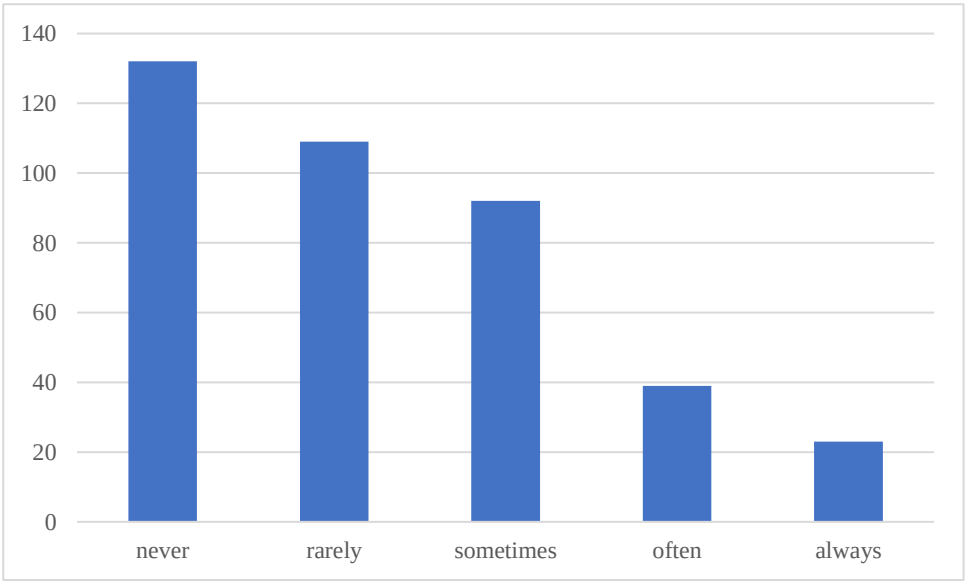
d) *The average daily time spent searching for health information (n = 407)*



e) *The frequency of usage of the Internet for health-related information during pregnancy in comparison to the period before pregnancy (n = 410)*



f) *The frequency of talking to gynecologist about health-related information found online (n = 395)*



Curriculum Vitae

Matea Šoštarić completed her undergraduate (2016) and graduate studies in psychology (2018) at the Faculty of Humanities and Social Sciences in Zagreb, in the field of clinical and health psychology. Since 2021-2023, she has been employed as an Associate on the project *"Digital platform for prevention and intervention for mental health problems (Diplee)"* at the Department of Psychology, Faculty of Humanities and Social Sciences in Zagreb. In this role, she contributed to the development of mobile applications addressing social anxiety and sexual difficulties. Since 2023, she has been working at the same Department, specifically at the Clinical and Health Psychology Unit, as an Assistant. Her responsibilities include teaching various courses in clinical and health psychology. She co-led the course *"Summer school of psychology"* on the topic of compulsive sexuality. Currently, she is involved in the project *„Health and Psychosocial Long-term Effects and Coping Resources in Severe or Critical COVID-19 Survivors: A Qualitative Study“.*

She enrolled in the doctoral program in psychology at the same Faculty in 2019 as a recipient of the Excellence Scholarship from the Faculty. In 2023, she also enrolled in the postgraduate specialist program in clinical psychology, which she attends regularly. Her research interests revolve around the impact of modern technologies on mental health. To date, she has published four papers in journals, one book, two book chapters, and presented at over 10 international conferences. She coordinates the *"Reach for the STAR(s)"* initiative, which organizes webinars for professionals in the field of clinical psychology (all in STAR Society).

Since 2019, she has been participating in the training for cognitive-behavioral therapy and is currently in the final supervisory stage of her education. In addition to her academic work, she provides psychological counseling and psychodiagnostics to clients. She utilizes cognitive-behavioral therapy (CBT), acceptance and commitment therapy (ACT), and compassion-focused therapy (CFT) in her practice, in line with her completed training and additional educations. She has also completed numerous courses on the application and interpretation of psychodiagnostic instruments used in her work.

She is a member of the Croatian Association for Behavioral-Cognitive Therapies (HUBIKOT), the Croatian Psychological Chamber (HPK), and the Stress, Trauma, Anxiety, and Resilience Society (STAR).

Publications

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