

The Use and Impact of Online Communities in Healthcare

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Contribution of Authors

In this dissertation, Ghazaleh Aghili Dehkordi was the first author and Dr. Liette Lapointe was the second author. The main contribution of the first author was to write the manuscript in its entirety. Dr. Liette Lapointe extensively reviewed the manuscript and provided feedback to the first author on how to improve this thesis.

Thesis Abstract

Healthcare information is now accessible in online communities and distributed by several users who are sharing sometimes reliable information but also misinformation, often grounded in their personal experiences. In this shift in healthcare information sharing in online communities, we see new ways of interaction and unexpected individual outcomes. However, little is known currently on the use and impact of online communities in health care. This thesis proposes three essays to examine 1) peer support in offline and online communities, 2) the role of online communities in knowledge delivery to patients, and 3) the impact of online reviews on risk-sensitive decisions. This thesis brings about three main contributions to this burgeoning stream of literature. First, we provide a framework for comparing offline and online peer support communities, highlighting the main elements of peer support, identifying gaps, and providing future avenues for research. Second, we show how the particular technological configurations deployed in offline and online communities influence patients' decisions. Third, we explain the role of online reviews in risk-sensitive decision making and in reducing cognitive dissonance for individuals.

Résumé

L'information sur les soins et la santé est désormais accessible dans les communautés en ligne. Cette information est distribuée par plusieurs utilisateurs qui partagent des informations parfois fiables mais aussi des informations erronées, souvent fondées sur leurs expériences personnelles. Ces changements dans le partage d'informations sur les soins de santé dans les communautés en ligne entraînent de nouveaux modes d'interaction et des résultats imprévus. Cependant, on sait peu de choses sur l'utilisation et l'impact des communautés en ligne dans les soins de santé. Cette thèse propose trois essais pour examiner 1) le soutien par les pairs dans les communautés de support traditionnelles et en ligne, 2) le rôle des communautés en ligne dans la transmission de connaissances aux patients et 3) l'impact des avis en ligne des utilisateurs sur les décisions sensibles au risque. Cette thèse apporte trois contributions principales à ce courant de littérature en plein essor. Premièrement, nous proposons un cadre conceptuel qui permet de comparer les communautés de soutien traditionnelles et en ligne, en soulignant les principaux éléments du soutien par les pairs, en identifiant les lacunes et en offrant des pistes de recherche futures. Deuxièmement, nous montrons comment les configurations technologiques particulières déployées dans les communautés traditionnelles et en ligne influencent les décisions des patients. Troisièmement, nous expliquons le rôle des avis en ligne des utilisateurs dans la prise de décision sensible au risque et dans la réduction de la dissonance cognitive chez les individus.

Chapter One: Thesis Introduction

In the last two decades, online communities have been known as one of the most influential types of information technologies that have transformative effects on how we collaborate, perform, and make decisions [1,2]. Online communities are virtual community spaces that provide individuals a platform to share information on their common interests [3]. Information sharing is key in the sustainability of online communities and occurs among mostly anonymous individuals often in the form of publicly available posts [4]. Users of online communities can create individual and community spaces to interact with one another [5]. Information shared in online communities has different uses and impacts on individuals due to its distinctive characteristics [6]. Hence, research on the use and impact of online communities requires a specialized subset of measures and theories, with adaptations from traditional research.

Similar to other fields, the healthcare domain has recently experienced online community use and such use is changing patient behaviors [7]. Online communities are shaping patients' behaviors by redefining social ties and changing their views on conformity and normality [8]. For example, "Patientslikeme" is a health-related online community that enables health-related information sharing among patients. It aims to transform the way patients manage their own conditions and how industry conducts research to improve patient care [9]. In fact, healthcare knowledge was traditionally bound to standardized guidelines and approved medical trials by the scientific community. Now the Internet and social media enable wide access to a mixture of scientific and non-scientific information where patients can get new knowledge but also be exposed to and influenced by misinformation [10]. Despite the common understanding that IT has impacted the

information that patients can access and use, a rigorous understanding in the academic literature regarding the use and impact of these online communities in healthcare is lacking. To fill this gap, we propose three essays.

The first essay is a scoping literature review that synthesizes prior work on peer support in offline and online communities for breast cancer patients, highlights the main aspects of peer support for breast cancer patients, compares and contrasts two main peer support platforms (i.e. offline and online communities), identifies gaps and provides future avenues for research for each identified peer support element. The second essay focuses on how the use of online communities changes the practices of knowledge delivery to patients. In this paper, we use content analysis to study the digital content shared in online communities. This research draws on material-discursive practices [11] to show how knowledge delivery is produced from different patterns dispersed across different entanglements of spaces and times [12]. We contribute to the literature by providing a grounded understanding of how the practices of knowledge delivery to patients in online communities are significantly different from the traditional ones. Finally, the third essay examines the impact of online reviews on patients' decision making in risky situations. A survey instrument is used as a primary source of data collection. Drawing on cognitive dissonance theory [13], we contribute to the literature by showing that online communities' features have significant and unexpected consequences on patients' decision making. All in all, this thesis aims at deepening our understanding of the shared information in online communities, how it is different from the traditional practices, and what are its consequences for patients. In particular, we focus on comparing peer support in offline and online communities for breast cancer patients, how knowledge delivery in

online communities is different from traditional knowledge delivery by professionals, and how the shared knowledge in online communities affects patients' sensitive decisions. In what follows, we will elaborate more on each study.

Summary of Essay #1: Peer Support in Offline and Online Communities for Patients with Breast Cancer: A Scoping Review

Research Question

It has been shown that a strong peer support network improves psychological and physical health of breast cancer patients [14,15]. Peer support is the support from similar others who share their personal experiences with one another. By so doing, they offer a novel and influential type of support that cannot be provided to patients by their family, friends, and healthcare professionals [16]. Peer support becomes even more important for patients with chronic diseases including breast cancer [17]. According to prior research, breast cancer is the second most common type of cancer for women in the United States and at least 1 in every 8 women will be diagnosed with breast cancer during their life time [18]. Many patients experience high levels of physical and psychological stress due to breast cancer diagnosis [19]. To ease their stress, help other patients, and learn new coping mechanisms, many patients join peer support groups and share their experiences with their peers [20].

Traditionally, peer support has been studied in offline settings (i.e. face-to-face) [15,21]. Different outcomes of peer support in such settings have been identified, such as increased coping ability and reduced stress. Recently, with the increased use of online platforms, more patients are increasingly using online tools to provide and receive peer support. As such, research has now focused more on peer support in online communities

[22,23]. However, the literature is sparse on the similarities and differences of peer support in offline and online communities and its impacts on patients' health. To fill this gap, we conduct a scoping literature review to synthesize prior work on peer support in offline and online communities.

In this study we focus on two research questions: (1) "What are the similarities and differences between offline and online peer support communities for breast cancer patients?" (2) "What are the main impacts of participating in offline and online peer support communities for breast cancer patients?" Guided by these research questions, this study aims to provide a comprehensive review of past and current research on peer support for breast cancer patients. The objectives of this research are twofold. First, to understand the differences between online and offline peer support communities in terms of types and impacts of peer support communities. Second, to provide suggestions for improving features of peer support online communities that lead to positive outcomes for breast cancer patients. Breast cancer is one of the most common cancers.

Conceptual Development

Peer support is a system of providing and receiving assistance using shared experience of peers or similar others [24]. Peer support is beyond the support provided by healthcare professionals because it is based on shared experience of people who went through similar paths. Joining peer support communities can create a sense of belonging for patients and improve their health outcomes [24]. Past literature has identified three types of peer support. First, informational support helps patients to seek advice from their peers about their disease. Second, emotional support helps patients to express and validate their emotions such as distress and sympathy with their peers. Third, tangible support includes

practical assistance such as financial help and accompanying patients to their appointments [25–27].

In the extant literature, conceptual models have been used to explain health behavior and outcomes in patient support communities [28,29]. A common thread in the extant literature says that perceived support has been identified as an antecedent for improved health outcomes (e.g. physical and psychological health). While most of these models explain offline peer support, recent research focuses more on online peer support. However, an important conceptual gap persists: as it stands, essentially, we do not know the similarities and differences between online and offline peer support communities. Our goal is to shed light on this issue by conducting a scoping literature review.

Research Method

We conducted a scoping review, using the systematic PRISMA approach to synthesize data that were extracted from different sources. The PRISMA approach embeds five steps. First, selection criteria: we selected those papers that focused on peer support in offline and online communities for breast cancer patients. Papers that were not written in English or did not examine breast cancer were excluded from our study. Second, information source and search strategy: we conducted an extensive search of two databases including ISI Web of Science and Medline for papers that were published between January 2007 and May 2017 and included the following set of keywords: peer support, breast cancer, health outcomes, and online communities. The first author and a research assistant conducted the literature search and the second author validated the search results. Third, study selection: the title and abstract of the articles were included based on our inclusion and exclusion criteria. Next, the full texts of the papers were read

by the first author and a research assistant. Overall, we included 58 papers in our study, out of which 36 discussed offline peer support and 22 discussed online peer support. Selected studies were coded as shown in Figure 18 and Figure 19 in Appendix A. Fourth, data extraction process: The first author performed data extraction from the selected studies using a coding scheme as shown in Table 2. Our coding scheme included region, research methods, community type, types of peer support, patient characteristics, online community platform, online community features, and health outcomes. The result of data extraction were discussed with the second author and any disagreement was resolved through consensus. Fifth, synthesis of results: Findings were summarized based on our coding scheme, and a framework to compare peer support in online and offline communities was presented (see Figure 7).

Findings and Contributions

Considering our first research question, we compared types of support, patient characteristics, research methods, and regions of the studies. Regarding types of support, emotional and informational support were used more than other types in both offline and online communities. A new type of peer support, namely decision making support, emerged from our analysis. This type of support helps patients to make some health decisions using their peers' advice. Decision making support is mostly used in online communities. Moreover, we found that the majority of the population in both offline and online communities are newly diagnosed patients. One reason for this could be that newly diagnosed patients are often overwhelmed with new information about their disease and the choices they have to make. To ease their stress and communicate with similar patients, they join peer support communities. Hence, there is a need to establish specific peer

support groups for newly diagnosed breast cancer patients. In addition, our findings showed that survey, randomized control trials, and qualitative methods were mainly used to study peer support in both offline and online communities. However, contrary to our expectation, social network analysis was not used in any of the selected studies.

Regarding our second research question, our analysis shows that improved psychological health was the most prevalent health outcome when patients participated in peer support communities. Online communities have more impact on improving psychological health and awareness, however, offline communities are more effective in improving patients' coping ability and quality of life. Our findings showed that microblogging (which is a popular online community platform) is rarely used to provide online peer support. Therefore, further research is needed to examine this issue.

The contributions of the study are both academic and practitioner-oriented. Our academic contribution includes providing an overview of peer support literature for breast cancer patients, comparing main peer support platforms, highlighting the main elements of peer support, identifying gaps, and providing future avenues for research. Our contribution to practice is to provide a better understanding of the structure of online peer support communities for healthcare professionals and breast cancer patients, to help patients use online communities as an effective platform to find their peers and enhance their psychological health, and to provide suggestions for platform designers to improve patient experience using online communities.

Summary of Essay #2: Apparatuses of Knowledge Delivery and Their Impact on Each Other: The Role of Online Communities in Vaccine Controversies

Research Question

The practice of knowledge delivery to patients is one of the most important aspects of health care. Healthcare professionals are continuously in the process of providing knowledge to their patients to inform them about their health conditions and help them make informed decisions [30,31]. Knowledge delivery to patients has been traditionally made by healthcare professionals who remained the best source of credible healthcare knowledge. However, with the extensive use of social media in recent years, patients have easy and wide access to several globally dispersed resources such as opposing medical beliefs, scientific and non-scientific evidence, and emotionally arousing stories of other patients to obtain healthcare knowledge [32].

In the shift to medical information delivery on social media, traditional practices of knowledge delivery to patients are challenged as patients can even be influenced by misinformation made available through social media. For patients, knowledge delivery, education about their health conditions, and explanations with regards to the consequences of their decisions on their health have typically been provided by healthcare professionals who were drawing on professional knowledge, field experience, and patient's medical history. However, healthcare knowledge is now being distributed widely online and in particular, on social media, by a large number of anonymous, non-professional individuals who are sharing informal information and a mixture of scientific/non-scientific evidence grounded in personal perspectives and experiences. Such mixture of information raises controversies - for example regarding the way

knowledge is constructed in this domain, the people who hold this knowledge, and the way this knowledge is being delivered. Hence, scrutinizing the role of IT (here social media) to understand how IT changes the established ways of knowledge delivery and to identify the consequences of such changes becomes significant.

While there has been considerable research interest in knowledge delivery to patients by physicians and its underlying mechanisms [30,31,33], we currently know little about what happens as healthcare knowledge delivery moves to social media. In this study, we aim to address this gap by conducting a qualitative study on knowledge delivery that focuses on vaccination as vaccines play a key role in public health intervention, contributing to dramatic declines in morbidity and mortality rates.

We address two main research questions: “How does the use of social media change the practices of knowledge delivery to patients?” and “How do traditional and social media-based knowledge delivery approaches influence each other?” To answer our questions, we will investigate two notable vaccine administration positions in the public health domain. First, we will study the vaccine administration guidelines provided by Centers for Disease Control and Prevention (CDC), which is based on professional standards for medication, approved clinical trials, and jurisdictional policies and procedures. Second, we will look into Facebook pages on (anti)vaccination, which are based on informal content, and a mixture of scientific and non-scientific evidence.

Conceptual Development

In this work, we use a material-discursive conceptualization of knowledge delivery to show how knowledge delivery is materialized in certain ways and what its performative

outcomes are [11,12]. In the following, we will briefly explain a material-discursive practice¹ and its performative outcomes, respectively.

First, a practice is any activity or phenomenon such as organizational processes, knowledge delivery, and etc. According to material-discursive view, there is no fixed boundaries to any phenomenon. For example, organizational processes are not stable processes with fixed properties. But rather, they are always changing and evolving. This change is due to the discourse among people and the impacts of their discourse on the phenomenon. In any practice (or activity), the discourse between people is materially expressed in bodies, objects, times, and places (see Figure 8). As a result of this materialization, some distinctions or boundaries are made. For example, people discuss and reach an agreement about the boundaries and properties of a particular organizational process. However, these boundaries might change, if people change their discourse. These boundaries are called “agential cuts” because they have agency in determining what is included in and excluded from consideration [34]. Second, when it is said that material-discursive practices have *performative outcomes*, it means that (1) these practices *perform* (i.e. make) some boundaries to the phenomenon, and (2) they dynamically change or reconfigure the boundaries [35].

Allow us to explain material-discursive practice (or apparatus) through an example. Consider knowledge delivery to patients as a “practice”. This practice can be conducted in a physician’s office, or in online communities. In the physician’s office, the discourse is between a doctor (i.e. an expert with formal medical training) and a patient. The discourse is based on scientific facts and patient’s medical history. The discourse takes place in

¹ Also known as “apparatus”

doctor's office during patient's appointment and can be materially expressed (i.e. materialize) in booklets, doctor's instructions, pictures, etc. The performative outcomes of this practice can be specific treatment that the patient should follow, prescribing medication, or taking blood tests. On the other hand, knowledge delivery practice can take place in online communities where several anonymous users share their personal experiences. Their discourse may have no significant scientific support and can materialize in "comments", "posts", photos, and videos. Due to asynchronous nature of online platforms, the discourse can happen anytime and anywhere. The performative outcomes of this practice can be neglecting to take a medication, using only natural remedies to cure a disease, or using specific coping mechanisms.

Methodology

For the purpose of this study, we adopted a grounded theory approach [36,37] to fully comprehend how knowledge delivery apparatuses are constituted through specific material-discursive practices, what their performative outcomes are, and how the apparatuses influence each other. As shown in Figure 10, first, we searched the ISI Web of Science for papers on vaccine administration. Papers in English, published between January 2000 and January 2018 were considered. Publicly available vaccination guidelines of the Centres for Disease Control and Prevention (CDC), as well as papers that focused on vaccine knowledge delivery in offline and online interactions were included in our study. All types of vaccines were considered in our data analysis. In addition, data from public vaccination and anti-vaccination online communities on Facebook, including the "Dr. Tenpenny on Vaccines and Current Events" (hereafter "DT") and the "Refutations to Anti-Vaccine Memes" (hereafter "RA") pages were collected. In these online

communities people publicly share their experience and knowledge about the benefits and risks of vaccines.

As we pursued our data collection and analysis, we also remained alert to emerging ideas. As this is an exploratory study, inductive and iterative data analysis were used [38] where an examination of similarities between various categories was conducted to develop the concepts of material-discursive practices. In the first round of coding, we identified offline and online community-based knowledge delivery practices to patients, their performative outcomes, and their influence on each other. Next, we used Barad's conceptual framing to compare offline and online knowledge delivery practices. We then conducted multiple rounds of coding to identify emerging theoretical categories and develop key contrasts.

Findings and Contributions

Our findings show that offline knowledge delivery practices materialized in different ways including face-to-face interactions and/or written information during a physician visit, one-on-one or group classes or seminars, and information sessions. In offline practices patient and physician are in close proximity and have the opportunity for eye contact, observing body-language for additional clues, and resolve patient dilemmas about the vaccination by providing expert advice to the patient. Physicians follow established guidelines to deliver knowledge to patients. In the US, some of those established guidelines can be found in the Communicable Disease Center (CDC) website. As a case in point, to counter anti-vaccine claims and facilitate a successful vaccine discourse with patients, CDC suggests different communication strategies to healthcare professionals. Moreover, CDC provides different educational content to patients about vaccination.

Regarding online practices of knowledge delivery, online communities are configured to allow interactive discourse between many users simultaneously. Not only is the speed of communication substantially higher, but also the amount of information in online communities has increased greatly, including scientific and non-scientific information. Online communities provide an equal opportunity to all viewpoints including pro and anti-vaccine views. These communities are configured to allow outlier and small extremist opinions the same space as widely accepted scientific views. As a result of this materialization, the performative outcomes of knowledge delivery in online communities include spreading doubt in the safety of vaccines and increasing vaccine controversy views among people. Search engines also have a role in giving more visibility to anti-vaccine content. For instance, search engines show anti-vaccine pages among the first lines of results when people search vaccine-related keywords. In fact, many users can be exposed to vaccine controversies without even searching for it, via advertisement, suggestions, or tagging systems. The increasingly interactive and social configuration of online communities makes individuals more exposed to anti-vaccine content. The algorithms that are used to filter and rank content before presenting them to users are influential in knowledge delivery in online communities. For instance, these algorithms show the most “liked” comment on top of other comments, giving users the impression that it might be true because many others liked it. Hence, compared to offline knowledge delivery practices, anti-vaccine claims seems more legitimate, scientific, and believable by patients in online communities.

Drawing on the material-discursive perspective enables us to examine knowledge delivery practices as materially constructed within people, things, actions, texts, spaces and times.

Using this perspective, we can argue that knowledge is produced by formally trained healthcare professionals using written instructions and guidelines, in their offices during patient's appointment. This knowledge is significantly different from emotional and personal experiences that are publicly posted in online communities by anonymous people.

We created a timeline to show important events related to vaccine administration and the influence of pro and anti-vaccine views on each other since the invention of the first vaccine in 1796. Table 12 (see page 101), provides a timeline of vaccine administration, anti-vaccine movement, and how they influenced each other. [39–43]. Moreover, knowledge delivery practices in online communities can have performative outcomes on offline knowledge delivery practices through collective actions and oppositions to policies that promote vaccination, which in turn triggers actions and reaction from the government, CDC, and RA. More specifically, the anti-vaccine movement in online communities resulted in government response and 1) passing bill SB 277 in June 2015 at California State Senate and 2) publishing additional educational materials supporting vaccine safety to the public. These enactments changed the materializations in offline knowledge delivery.

The contributions of this work are twofold. First, we showed that the particular technological configurations deployed in offline and online community-based knowledge delivery practices influence the vaccine controversies. Second, shifting the focus from one material-discursive practice to many practices helps us to have a more comprehensive understanding of how performative outcomes of one practice can reconfigure local causal structures, boundaries, and properties of another practice.

Summary of Essay #3: Online Reviews and Their Impact on Risk-Sensitive Decisions

Research Question

It has been shown that online reviews play a key role in the success of online communities since they influence social processes and norms, as well as user opinion and decision making [44,45]. As decision making plays a key role in understanding individual behavior [46], several studies examined the impact of online reviews on decision making [47–49]. Online reviews can lead people to change their decisions because they provide new information that was not available to them before. [13,47,50]. While prior studies have provided great insights regarding online reviews, two issues remain unexplored.

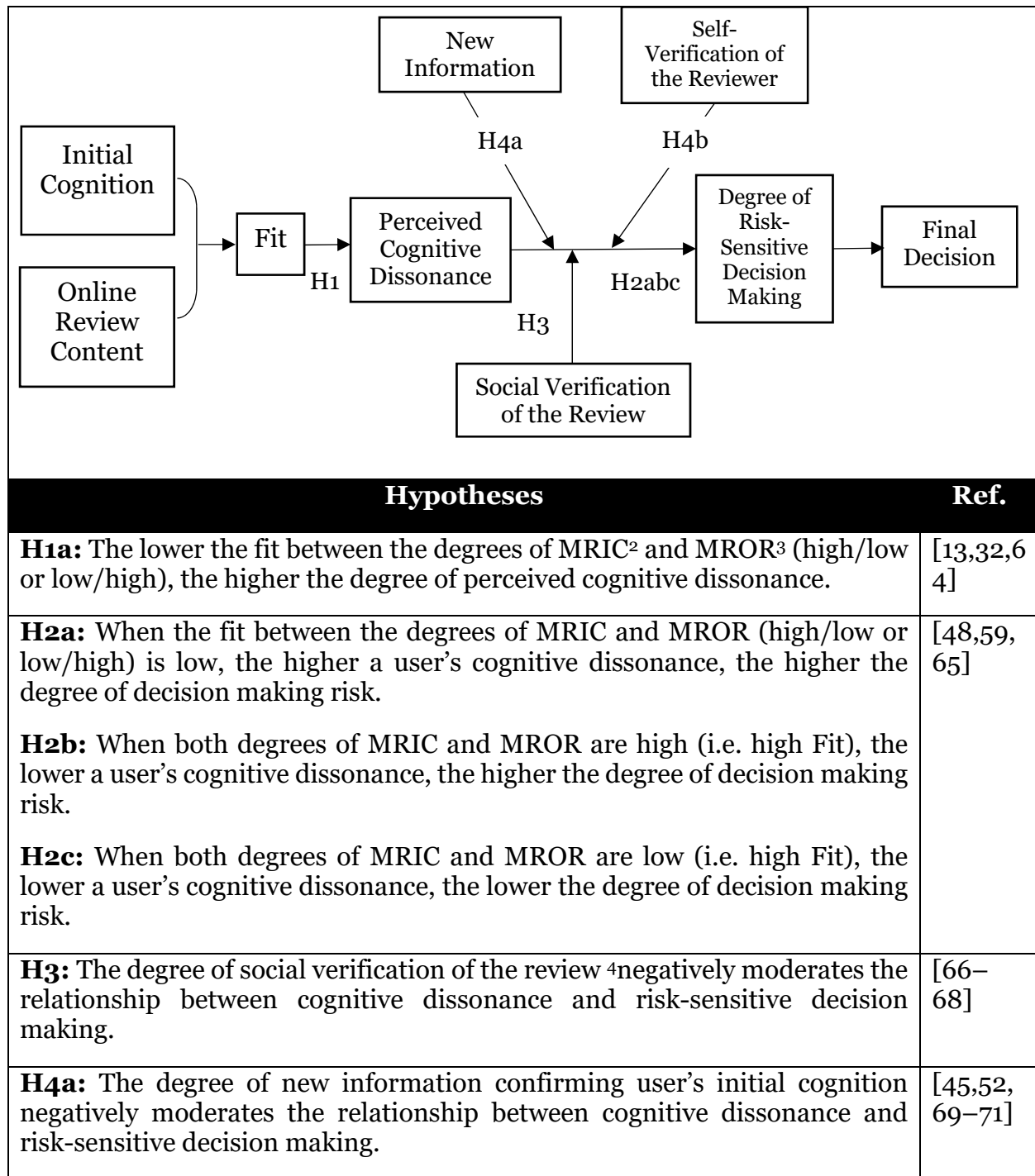
First, user decisions have been mostly considered with regards to online purchases [47,49]. However, less attention was paid to other types of decisions including risk-sensitive decisions [51,52]. Recently, there was an increase in the use of online communities for decisions in risk-sensitive domains such as healthcare. For example, as we showed in the first essay of this thesis, patients are increasingly sharing their experiences regarding their treatments and providing decision making support to their peers [53–57]. As such, it becomes important to understand how online reviews influence risk-sensitive decisions. Decisions are considered risk-sensitive when there is uncertainty about their potentially significant and disappointing outcomes [58]. In this work, we study the impact of online reviews on risk-sensitive decision making in the context of healthcare since health decisions are often considered risky with significant consequences in people's lives [59].

Second, in the extant online review literature, there are some pre-assumptions about user cognition that can create some issues. In some studies, it has been assumed that early reviewers hold different cognitions than do later reviewers [60]. However, in other studies, it has been argued that online reviews are perceived to be more helpful, when they are in agreement with the previous reviews [50]. Considering these two views, one can conclude that even when many people provide online reviews, reviews might be biased because they are mostly in agreement with early reviewers who are known to have different preferences [60]. Such issues can be resolved if we change the underlying assumption in these studies. More specifically, prior studies assume that people only rely on online reviews to shape their initial cognitions [50]. Such assumptions might not hold when decisions are risk-sensitive. In risky situations, people often use several information sources to shape their initial cognitions, before accessing online reviews. As a case in point, patients consult with their physicians to form initial cognitions about their health and treatments [62]. Thus, using theoretical problematization [63], we argue that in the online review literature, previous assumption about how initial cognition is shaped should be revised as follows: A person can shape an initial cognition from information sources other than online reviews. Following our problematization, we study the role of initial cognitions in risk-sensitive decision making via three research questions. 1) “What is the impact of online reviews on risk-sensitive decision making?”, 2) “What is the impact of online reviews on user cognition, when they have not obtained their initial cognitions from online reviews?”, and 3) “How can online review users reduce their cognitive dissonance?” In the next section, we will elaborate on the theoretical underpinnings.

Research Model and Hypotheses

Cognitive dissonance theory explains the psychological conflict from holding two or more incompatible cognitions simultaneously. The theory indicates that dissonance is psychologically uncomfortable enough to motivate people to achieve consonance [13]. In online communities, users can receive feedback from a large number of anonymous individuals who are sharing a mixture of scientific/non-scientific evidence grounded in personal perspectives and experiences. Such mixture of information in online reviews can create cognitive dissonance [13] and affect risk-sensitive decisions. Drawing on cognitive dissonance theory, a research model composed of four hypotheses is proposed and included in Table 1.

Table 1: Conceptual Model and Research Hypotheses



² Medication Risk from Initial Cognition (MRIC)

³ Medication Risk from Online Review Content (MROR)

⁴ Social proof (# of likes)

H4b: The degree of self-verification of the reviewer ⁵ negatively moderates the relationship between cognitive dissonance and risk-sensitive decision making.	
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Research Methodology

The data collection process relied upon individual answers provided via a secure, web-based survey, built and administered in Qualtrics. Previously developed and validated instruments for the control variable “self-efficacy” [72] was adopted and modified based on our context. Survey items for all other constructs in our model required adaptations of existing measures as shown in Table 16. The study’s sample frame composed of 400 respondents who use online reviews about medication use during their pregnancy or breastfeeding period. Regression analysis and Structural Equation Modeling (SEM) techniques in SmartPLS 3.0 [73,74] were used to analyze the data.

Findings and Contributions

Considering the increased use of online reviews by users to reduce uncertainties in their decision making [9] and share information [75], in this work we researched how online reviews impact individuals’ risk-sensitive decision making. As people with different perspectives share their personal experiences in online reviews, there is a high chance that users experience cognitive dissonance [76]. In this work we proposed a model based on cognitive dissonance theory [13]. More specifically, we argued that when there is misfit between user’s initial cognition and online review content, the user will experience cognitive dissonance which leads to higher degrees of risk in their decision making.

⁵ The depth and breadth of the depth and breadth of information that the reviewer makes available to other users in the online community about her/himself such as profile data, preferences, etc.

However, users can reduce their cognitive dissonance by considering social verification of the review, self-verification of the reviewer, or by finding new information that confirms their initial cognition. Our findings provide support for all our hypotheses, except H2b and H3.

In H2b, we argued that when both initial cognition and cognition from online reviews indicate that the overall risk of decision is high, the degree of decision making risk is high, although cognitive dissonance is low. However, our findings did not provide support for H2b. Moreover, in H3, we argued that users can reduce their cognitive dissonance by seeking social verification from others and reduce the degree of decision making risk. However, this hypothesis was not supported. One possible reason for this result could be that social verification (i.e. social proof) may only have an impact if the user cannot find similar others to validate her/his cognition.

The main contribution of this paper is to show how online reviews can impact risk-sensitive decision making, specifically when people form their initial cognitions using sources other than online reviews. Such sources can be practitioners, books, friends, etc. To our knowledge, most of the prior studies have assumed that people only rely on online reviews to shape their initial cognitions [77]. However, when making important decisions, people also use other sources of information [78]. We also contributed to the literature by developing a new scale to measure constructs in our model including cognitive dissonance, new information, and risk-sensitive decision making.

Chapter Two: Essay #1 –Peer Support in Offline and Online Communities for Patients with Breast Cancer: A Scoping Review

Introduction

It is widely recognized that peer support or the support provided by fellow or former patients enhances psychological adjustments to breast cancer and increase survival rates [14,15]. Countless positive health outcomes from decreased stress [20] to enhanced coping strategies [79] have been associated with having strong peer support networks. As a particular form of social support, peer support has been the focus of several studies [16,80,81]. While social support can be considered a more general term encompassing support from family, friends, and healthcare professionals, peer support only focuses on the support from similar others. The rationale behind the peer support is that similar others share their personal experiences and provide a unique perspective to the support process which is beyond the scope of family, friends, and healthcare professionals [16]. Several factors contribute to the proliferation of research on peer support, including its role in etiology of disease, altering behavior and emotions, treatment, and rehabilitation programs [17,82,83].

Peer support has been widely used in the context of chronic disease including breast cancer [16,17,84]. Breast Cancer is the second most common type of cancer for women in the United States and at least, 1 in every 8 women will be diagnosed with it during their life time [18]. Breast cancer diagnosis is a major stressor that can lead to physical, psychological, and social crises for patients. Hence, many breast cancer patients

experience difficulties such as depression, anxiety, loneliness, uncertainty and loss of control, decreased self-esteem, and disruptions to relationships [19,84]. It is widely recognized that peer support can reduce stress and lead to positive health outcomes including physical and psychological well-being and healthy behaviors [85,86]. Peer support can reduce stress by affecting either assessment of the potential threat or mastery of coping skills for individuals [20]. For instance, some events will be perceived as less threatening if one perceives that her/his network is ready to respond with help when it is needed [87].

A large body of work has studied peer support and its impacts in offline settings [19,21,85]. They showed that peer support can act as a stress buffer, enhance coping ability, and improve quality of life for patients. According to extant knowledge, peer support is built on the foundations of similarities, trust, and assistance to the person in need [19,80]. Furthermore, studies have recently begun to examine peer support in online communities [22,23,88–90]. It appears that one of the main reasons that cancer patients participate in social networking sites is to provide and receive peer support [91]. Yet, our knowledge is limited regarding the similarities and differences of peer support in offline (i.e. face-to-face) and online communities and its impacts on patients' health. Such understanding can add to the extant research by providing an overview of extant peer support literature for breast cancer patients, highlight main elements of peer support for breast cancer patients, compare and contrast two main peer support platforms (i.e. offline and online communities), identify gaps and provide future avenues for research for each identified peer support element. From a practical perspective, this study can enable healthcare professionals and breast cancer patients to better understand the structure of

online peer support and help patients to use online communities as an effective platform to find similar others and improve their psychological health.

This scoping literature review synthesizes prior work on peer support in offline and online communities to address the following research questions. First, “what are the similarities and differences between offline and online peer support communities for breast cancer patients?” Prior work showed that there are key differences in terms of age, education level, income, and health status between online and offline information seekers [92]. For example, older patients who have lower incomes may be less educated and less likely to seek online health information [92]. This suggests that patients’ characteristics influence where peer support is sought. Understanding differences between online and offline peer support communities can help patients and healthcare professionals to identify an optimal means of support based on patient characteristics and needs. Second, “What are the main outcomes of participating in offline and online peer support communities for breast cancer patients?” Such understanding can be beneficial for two groups. First, it can help patients to evaluate the outcomes that they can gain from peer support communities. This evaluation can be consequential in patients’ participation rates. Second, designers of peer support programs can also identify and enhance those features that lead to positive outcomes. In so doing, they can improve overall patient experience in peer support communities.

In the following, we first start with defining peer support and reviewing existing models regarding online and offline support communities for cancer patients. In light of these models, we identify the types and impacts of peer support and develop a coding scheme

for our literature review. After presenting the findings, we discuss the implications of this work for research and practice.

Peer Support Models

Peer support is a system of giving and receiving help through the shared experience of similar others [84]. Shared experience is the core attribute of peer support that enables a peer to offer experiential empathy which is beyond the scope of healthcare professionals. Furthermore, patients develop a sense of belonging with their peers that positively impacts their health outcomes [24].

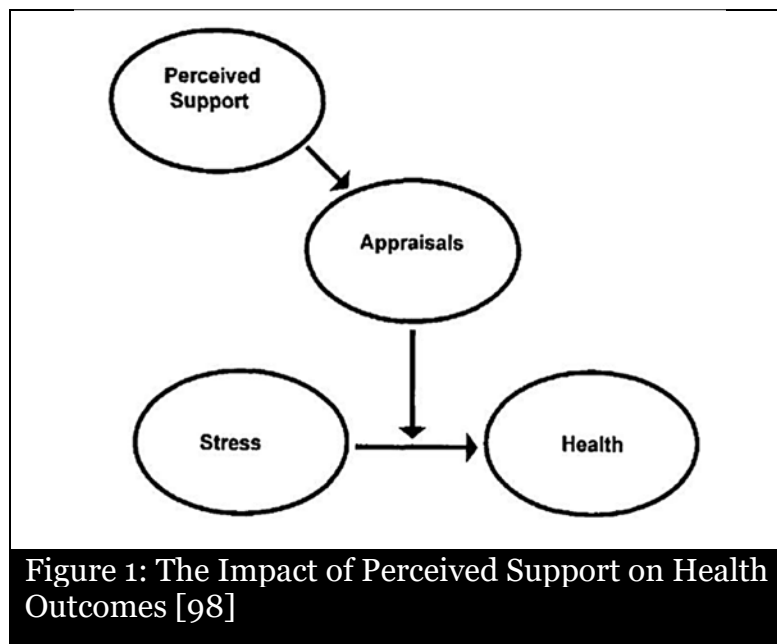
Prior work showed that patients increasingly rely on peer support to exchange information, practical tips, and personal experience about their condition [93,94]. Peer support can buffer the harmful impacts of major stressors on physical and psychological well-being [95]. Three main types of peer support include informational, emotional, and tangible support [25,84,96,97]. Informational support helps people to seek advice; emotional support involves the expressing of emotions such as empathy; and tangible support encompasses concrete and direct assistance (e.g. financial help) from others [25–27]. Moreover, prior work has identified five modes of peer support including one-on-one face-to-face, one-on-one telephone, group face-to-face, group telephone, and group Internet [84]. In the following sections, we discuss peer support outcomes and existing models in offline and online environments.

Peer Support in Offline Communities

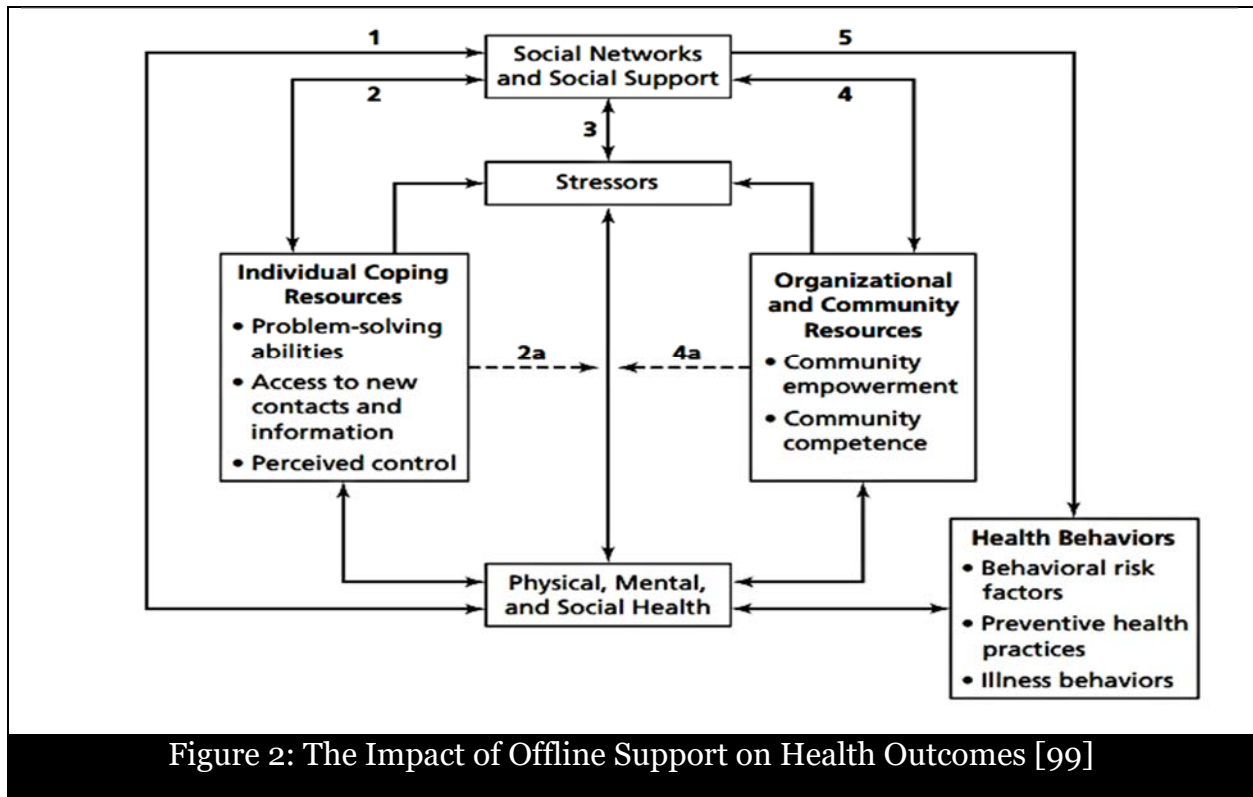
Peer support has been identified as an important contributor to general well-being that buffers the impact of stress on health by reframing threat appraisals and improving coping responses and behaviors. Offline peer support communities are often designed

and administered by healthcare professionals as a series of face-to-face meetings that cover the most important topics related to patient disease. Patients can join these communities/groups to share their experiences and discuss about topics related to their disease. Discussions are often facilitated by a social worker or a healthcare professional and time and locations of the meetings are set in advance. If patients cannot make it to a session, they will miss the conversation [93,94].

Perceived support has been identified as an antecedent for health outcomes in different models [28,29]. In the first model (see Figure 1), adopted from prior work [98], stress arises when one appraises a situation as threatening and does not have an appropriate strategy to cope with the stressful event. As seen in Figure 1, perceived support can act as a stress buffer through supportive actions of others or the belief that support is available. Given the enhanced coping ability of the individual, events can be appraised as less stressful and more positive physical illness symptoms, and psychological health outcomes including reduced depression and anxiety can be achieved [28,98].



In the second model (see Figure 2), adopted from prior work [99], it is shown that perceived support can increase healthy behaviors among patients. The model illustrates that social networks and social support are the starting point or initiator of a causal flow towards health outcomes. By meeting basic human needs for companionship, intimacy, and a sense of belonging, social ties can enhance well-being and health. For example, social networks and social support can enhance an individual's ability to access information and solve problems. A sense of personal control will be enhanced, if the support provided helps to reduce uncertainty. Social support can encourage healthy behaviors for individuals including adherence to medical regimens and help-seeking behavior. Social support may also affect recovery from disease. Moreover, social support has a great potential to affect major social problems such as behavioral patterns in patients and their reactions to health messages and message delivery [99].

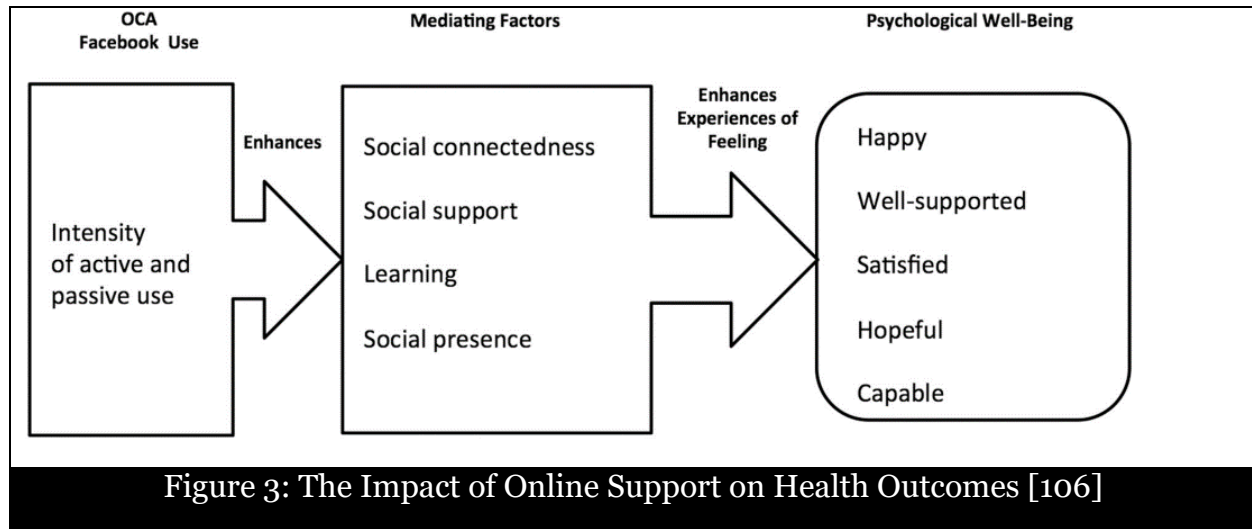


Peer Support in Online Communities

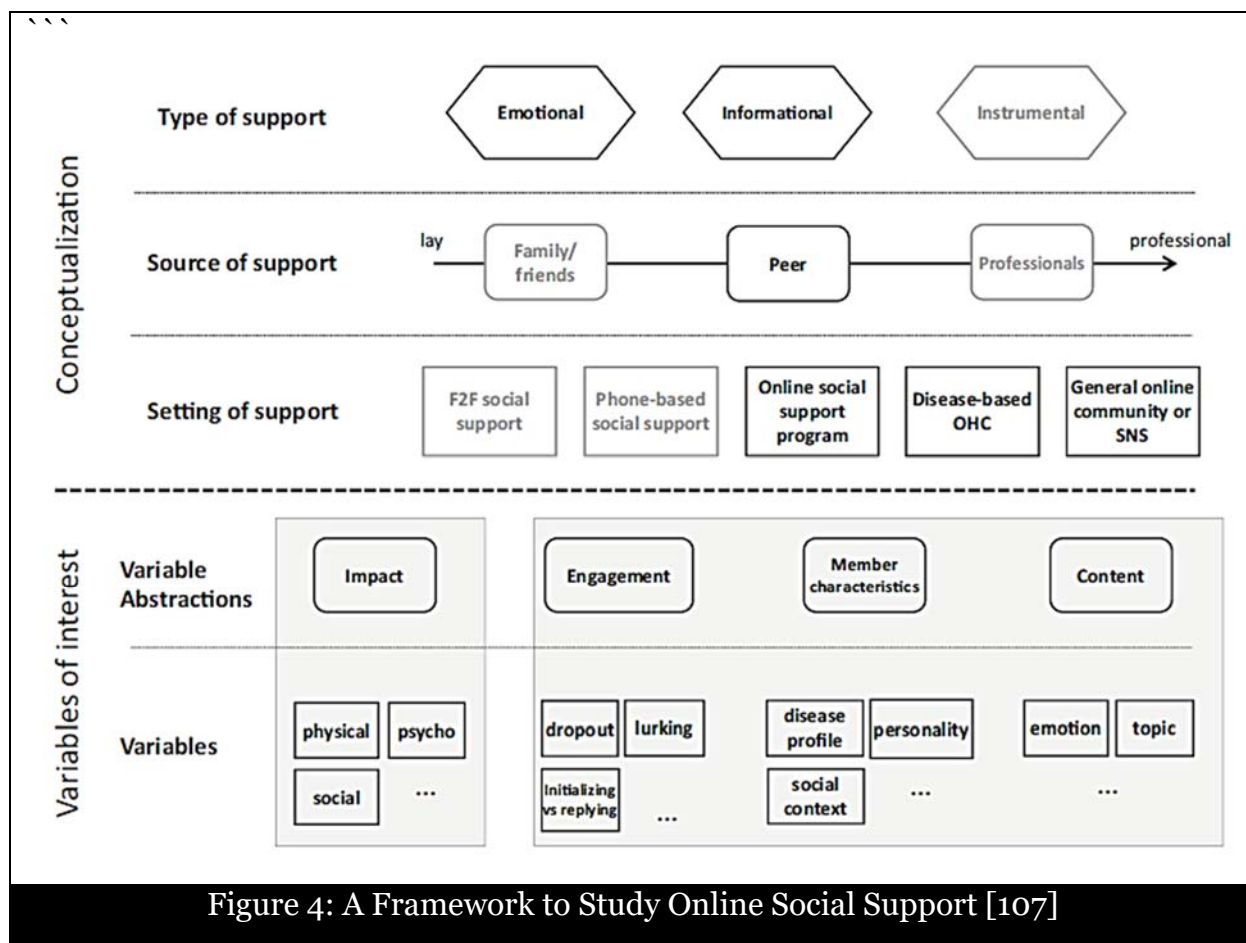
In the last years, online communities have been one of the most influential types of information technologies influencing how we collaborate, share information, and provide peer support [1,3]. Cancer patients use the Internet for different activities such as seeking a healthcare provider, communicating with a physician, seeking advice regarding their medications and treatments, and using online support groups. However, seeking peer support is the most popular online activity among them [100,101]. In particular, online communities have recently gained popularity in the healthcare domain, and are changing the nature and the speed of interactions among patients [102]. Online communities help patients easily find many similar others [89]. When patients feel stressed about their diseases, they can join these sites to seek emotional support, sympathy, appreciation, etc. from others [103]. Moreover, these communities are changing how healthcare

organizations communicate with patients to achieve their objectives [104]. As a case in point, the Mayo Clinic Center for Social Media aims at engaging hospitals, healthcare professionals and patients to collaborate and improve global health. Although some physicians consider online communities to be a potential liability and reject novel concepts or practices created by these communities [103], prior studies have shown that patients are using communities to provide and seek peer support by sharing their personal experience, creating awareness, and raising funds [102,105]. For example, “Patientslikeme” is an online community for peer support that enables information sharing and aims at transforming the way patients manage their own conditions, changing the way industry conducts research, and improving patient care [9].

Using online communities has positive impacts on perceived support and promoting patient focused health information [101]. Different theories including belongingness theory, social support theory, and social presence theory have been used to explain the process through which support is provided in online communities [106]. As shown in Figure 3, online peer support improves individuals’ psychological well-being and satisfaction with life [90]. It also helps them to feel happy, hopeful, well-supported, and capable of managing their diseases [106].



Peer support is the most cited source of support in online communities [107]. As researchers have only recently begun to characterize online support, sound evidence to support the effectiveness of online peer support is still in development [90]. However, as shown in Figure 4, recent studies highlighted the positive physical, psychological, and social impacts of online peer support such as reduced depression and distress, as well as improved physical well-being and quality of life [97,107,108]. Patients learn different types of coping strategies such as problem-focused coping, coping focused on getting support, and coping focused on stopping unpleasant emotions and thoughts. For example, when problem-focused coping cannot address their problems, getting support and overcoming undesirable and negative emotions are very useful coping strategies for the patients [109]. Better coping strategies is positively associated with increased quality of life for cancer patients [110].



In sum, while offline peer support has been widely studied in the extant literature, there is an emerging stream of research focusing on online peer support and its impacts. This work aims to reveal their similarities and differences in terms of their components and impacts on breast cancer patients by conducting a scoping literature review.

Methodology

Scoping reviews have become a popular approach to reviewing health-related research [111]. Scoping reviews include a process of summarizing a range of evidence in order to convey the breadth and depth of a field [112]. In scoping reviews, authors do not usually assess the quality of included studies, but rather conduct a conceptual analysis of the literature [113]. Conceptual analysis may include the 'mapping' of existing empirical

evidence to describe and interpret issues that will inform further research and development opportunities [111].

To fully comprehend the multifaceted phenomenon of peer support in offline and online communities, this study follows a systematic approach in which data extracted from various sources is synthesized to identify dimensions of peer support. This scoping review is conducted in line with the PRISMA criteria: (1) selection criteria; (2) information source and search strategy; (3) study selection; (4) data collection process and synthesis of results. Using PRISMA helps researchers develop a systematic approach with a greater understanding of relevant terminology, core concepts, and key items to report for scoping reviews [114]. In the following sections, we present the methodology and discuss our findings.

1. Selection Criteria

The articles that study peer support in offline (e.g. face-to-face) and online communities for breast cancer patients were included in our study. In the review, we considered online communities in social networking sites, microblogging, and online forums. Those articles that studied the design of online communities, not focused on breast cancer, not in English, or not related to peer support were excluded from our review. Moreover, those papers that fell in “editorial”, “medical protocols”, “other types of information systems (i.e. EMR)” categories were excluded from our analysis.

2. Information Sources and Search Strategy

Our review was based on an extensive search of two databases including ISI Web of Science and PubMed. Papers in English, published between January 2007 and May 2017, were considered. The first author and a research assistant conducted the literature search

and the second author validated the search results. A librarian was consulted to ensure the comprehensiveness of the results. For offline communities, three sets of keywords were searched in combination:

2.1. Peer support

- a. Supportive behavior, informational, emotional, and tangible/instrumental support, financial support, sharing/receiving support, social support, peer support, support, sharing experiences/information/emotional exchange, supportive interactions)
- b. Perceived support (recipients’/providers’ perceptions of support, coping, coping strategy, sympathy, caring, perceived peer support, perceived informational/tangible/emotional support, enacted support, received support)
- c. Support Networks (support networks patients, peer)

2.2. Breast Cancer

- 2.3. Health outcomes** (improved health, satisfaction, reduced distress, stress, physical/psychological well-being, mental health, depressive symptoms, quality of life, happiness, happy, hope, hopeful, survival, survival rate, mortality/death rate, self-esteem, self-efficacy, confidence, health decisions, health behavior, coping)

To better circumscribe papers dealing with online communities, we added the fourth set to the previous sets of keywords and performed the second round of search (i.e. using “AND” operator for search).

2.4. *Online communities* (information systems, online support, Web 2.0, health 2.0, social media, social networks, blogs, forums, media sharing, medical/health informatics, and online communities)

We also hand-searched the reference lists of all the selected references. We used Zotero software to manage the references and eliminate duplications.

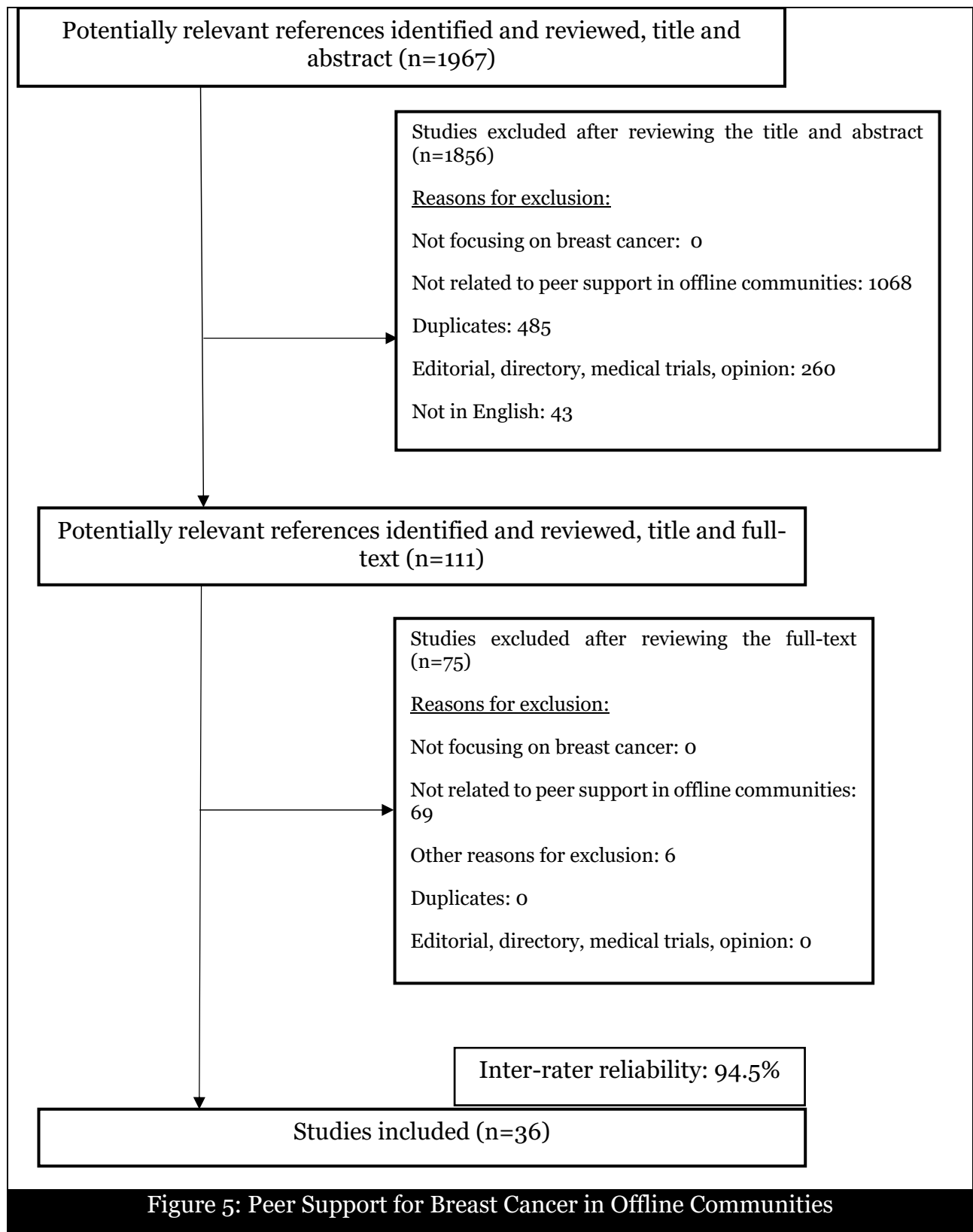
3- Study Selection

Study selection was conducted by the first author and a research assistant, blinded in parallel. First, the title and abstract of the selected papers were considered based on our inclusion and exclusion criteria. Studies that focused on peer support, breast cancer, and health outcomes in offline and online communities were included. Editorial, directory, medical trials, and opinion pieces were excluded. If there was doubt, the paper was included for full text reading. In the second round of selection, the full texts of the papers were read by the first author and the research assistant.

Our initial search resulted in 1967 and 149 references for peer support in offline and online communities, respectively (see Figure 5 and Figure 6). Applying the inclusion and exclusion criteria, 1856 and 30 references were excluded based on the title and abstract for offline and online communities, respectively. Based on the full text review, 74 and 8 references were excluded based on the title and abstract for offline and online communities, respectively. The final sample consisted of 36 and 22 articles for offline and online communities, respectively.

In total 58 papers that were included in our study, out of which 36 discussed offline peer support and 22 discussed online peer support. See Figure 5 for offline communities' and

Figure 6 for online communities' studies. Any disagreement was resolved by consensus by the second author [115]. Selected studies were coded as shown in Appendix A. Interrater reliability for offline and online communities was 94.5% and 93.3%, respectively.



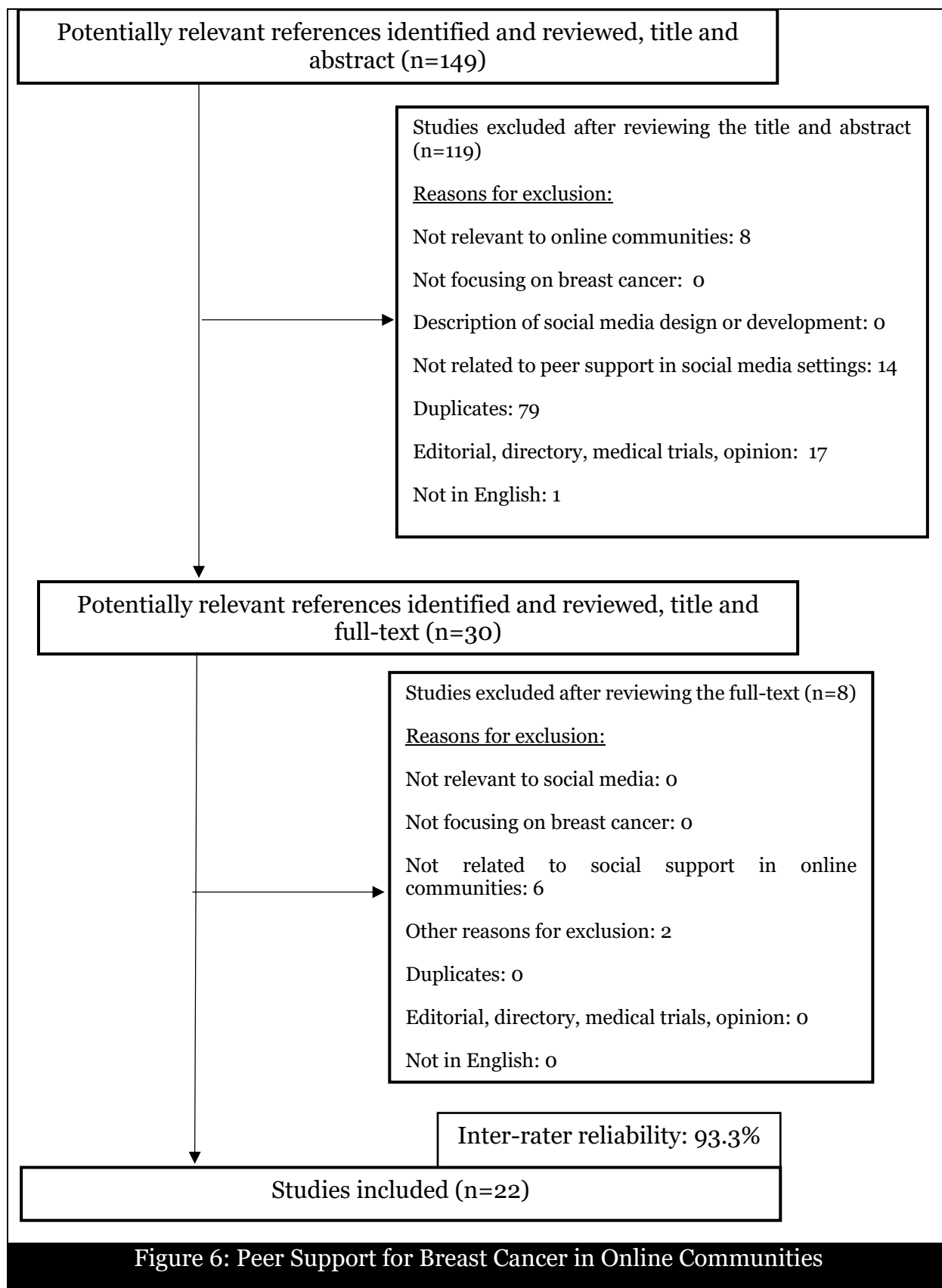


Figure 6: Peer Support for Breast Cancer in Online Communities

4- Data Extraction Process and Synthesis of Results

Data extraction from the selected studies was performed by the first author using our coding scheme (see Table 2). To synthesize data we identified types of peer support, patient characteristics, region, research methods, health outcomes, online community platform, community type, and online community features. These codes were based on the elements included in models found in the literature as discussed earlier and shown in Figure 1 to 4. In the data extraction and synthesis phase, any disagreement was resolved through consensus.

Table 2: Coding Scheme

Code	Categories of the Code
Reason for exclusion based on full paper	<ol style="list-style-type: none"> 1. Not focusing on breast cancer 2. Not related on peer support 3. Other
Community type	<ol style="list-style-type: none"> 1. Offline 2. Online
Research methods	<ol style="list-style-type: none"> 1. N/A 2. Survey 3. Qualitative 4. Randomized control trial (RCT) 5. Quantitative (e.g. econometrics) 6. Social network analysis 7. Mixed methods
Outcomes	<ol style="list-style-type: none"> 1. N/A 2. Health behavior 3. Physical health 4. Self-confidence 5. Coping ability 6. Psychological health 7. Awareness 8. Quality of life 9. Other
Type of peer support	<ol style="list-style-type: none"> 1. N/A 2. Emotional

	3. Informational 4. Tangible 5. Decision making 6. Other
Patient characteristics	1. Newly diagnosed 2. Relapsing 3. Survivor 4. Remission 5. Other
Community platform	1. N/A 2. Social networking sites 3. Microblogging 4. Forums 5. Other 6. Offline
Online community feature	1. N/A 2. Public discussion 3. Group messaging 4. Private message 5. Other
Region	1. N/A 2. North America 3. Asia 4. Europe 5. Africa 6. Other

Results

In this section we present our findings. In all descriptions, the first and second reported percentage corresponds to the number of studies that reported the results (e.g. type of support, patient characteristics, and etc.) in offline and online communities, respectively.

Type of Support

As shown in Table 3, type of support was mainly emotional (37%, 35%) and informational (30%, 29%). Other types of support were tangible or instrumental (9%, 3%), decision

making (5%, 15%), or not mentioned (19%, 18%). Although we had an a priori set of codes, we remained open to new emerging categories. As a result, a new type of support has also emerged from our coding, namely, decision making support. This type of peer support has been mostly used in online communities. In decision making support, patients are looking for their peers' experiences regarding their health decisions including deciding about a treatment or medication [79]. Decision making is an important part of the patient care as it assists patients in obtaining necessary information and becoming more involved in their encounters. In so doing, they can make decisions that are in line with their preferences, values, and needs [54,116]. Decision making support enhances key communication skills on information seeking and question asking of breast cancer patients [56].

Table 3: Synthesis of the Results: Type of support

Type of Support	Offline	Online	Description	Examples
<i>Informational</i>	30% [16,16,16,21,86,116-128]	29% [20,53,57,129-134]	Helps people to seek advice	Coping skills, medication, trajectory s
<i>Emotional</i>	37% [16,17,21,79,86,116,118,120-128,135-143]	35% [20,53,55,56,95,129,131,133,134,144,145]	Expressing of emotions such as empathy	Decreased stress, decreased negative thoughts and feeling
<i>Tangible</i>	9% [16,120,122,136,141,146]	3% [145]	Concrete and direct assistance	Financial assistance
<i>Decision making</i>	5% [79,116,136]	15% [53-57]	Help patients make health decisions	Treatment options

<i>Not mentioned</i>	19% [19,85,93 ,121,139,1 46–153]	18% [81,94,154– 156]	-	-
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Patient Characteristics

In majority of the online (64%) and offline (26%) studies, patient characteristics were not reported. Patients who participated in the peer support groups were mainly newly diagnosed (23%, 32%) or survivor (20%, 4%). Other patient's characteristics include relapsing (23%, 0%), remission (8%, 0%), or not specified (26%, 64%). See

Table 4. Majority of the studies reported on newly diagnosed breast cancer patients (32%) in online communities. However, patient characteristics were more diverse in offline communities, including survivors (20%) and relapsing patients (23%). There are two reasons for this result. First, patients in online communities may prefer not to disclose their characteristics, while patients in offline communities are identifiable. Second, newly diagnosed patients participate more than others in online communities. Further research in this area is required to understand why patient characteristics are more diverse in offline communities. As shown in Table 4, in both offline and online communities, newly diagnosed patients constitute the majority of the communities' population, which shows the need to develop stronger peer support groups to address their needs.

Table 4: Synthesis of the Results: Patient Characteristics

Patient Characteristics	Offline	Online	Description
Newly diagnosed	23% [21,118,119,123,135,136,139,140,148,152,152]	32% [95,129–131,134,145]	Patients who are newly diagnosed with breast cancer
Survivor	20% [17,85,86,126,137]	4% [156]	Patients who have successfully survived breast cancer
Relapsing	23% [116,122,127,138,141,153,153,157]	0%	Deterioration in the state of health after a temporary improvement
Remission	8% [116,138]	0%	A temporary recovery
Not mentioned	26% [19,79,120,121,124,125,128,142,150,151]	64% [20,53–57,81,94,132,133,144,154,155]	-

Region of the Studies

Studies were conducted in Europe (36%, 4%), Asia (28%, 9%), North America (22%, 59%), Africa (6%, 0%), and other regions (5%, 14%). Three percent of offline and fourteen percent of online communities did not report the regions of the studies. While most offline

studies were conducted in Europe, the majority of the online studies took place in North America. North American researchers are more interested in investigating online peer support communities. Since offline studies are more researched in the past, the distribution of the studies seems more even in terms of region in offline community studies. See Table 5.

Table 5: Synthesis of the Results: Region

Region	Offline	Online
Europe	36% [21,93,117,119,122,125,136,138,140,141,143,146,149]	4% [155]
Asia	28% [19,86,116,121,124,126,127,137,147,151]	9% [55,56]
North America	22% [17,85,118,128,135,142,148,150,152,153,157,158]	59% [20,53,94,95,130–132,134,144,145,156]
Africa	6% [16,79]	0%
Other regions	5% [120,123]	14% [54,57,133]
Not mentioned	3% [139]	14% [81,129,154]

Research Methods

As far as research methods are concerned, survey (25%, 32%), qualitative (31%, 27%), randomized control trials (33%, 23%), and mixed methods (8%, 18%) are the most prevalent methods used in studies. Quantitative methods were rarely used in both communities (3%, 0%). Contrary to our expectation, no study used social network analysis to analyze data. See Table 6. As online communities offer a great opportunity to

use this method, future studies can use it to investigate social structure in peer support network. The social structure of peer support communities can pave the way to understand interaction patterns among peers and the strategies used to communicate within the group, visualize the connections among participants, and analyze changes in participatory patterns of peers over time.

Table 6: Synthesis of Results: Research Methods

Research methods	Offline	Online
<i>Survey</i>	25% [79,122,124,139,146,148,149,151,153]	32% [55,56,95,129,134,154,155]
<i>Randomized control trial</i>	33% [21,85,93,118,121,126,127,138,140,142,143,147,152]	23% [20,53,132,145]
<i>Qualitative</i>	31% [17,19,116,117,119,120,125,128,135,137,141,150,157]	27% [57,81,130,131,133]
<i>Quantitative</i>	3% [136]	0%
<i>Mixed methods</i>	8% [16,86,123]	18% [54,94,144,156]
<i>Social network analysis</i>	0%	0%

Health Outcomes

With regards to health outcomes, improved psychological health (33%, 45%) was the most reported outcome. Improved coping ability (17%, 7%), awareness (11%, 16%), quality of life (10%, 3%), self-confidence (6%, 3%), physical health (6%, 7%), and health behavior (3%, 0%), were among the mentioned outcomes. (1%, 6%) of the studies did not mention any outcome. (13%, 13%) of the studies reported mixed results. See Table 7.

Improved psychological health (e.g. improved emotional and mental health and reduced stress) was the most reported outcome in both offline (33%) and online (45%) communities. Improved coping ability, awareness, and quality of life were also among the prevalent peer support outcomes in both communities. While offline communities have more diverse outcomes, online communities reported other (i.e. mixed outcomes) including both increased and decreased emotional well-being [145,159]. They showed that if patients talk about themselves [159] or have low emotional competence [145], they might experience negative emotions in peer support communities.

Table 7: Synthesis of the Results: Health Outcomes

Health Outcomes	Offline	Online	Description
Psychological health	33% [16,17,21,85,93,116,117,119,120,122,123,125–128,135,136,138,140,141,146–148,151]	45% [20,53,55,56,94,95,130–133,144,154,155]	Decreased negative emotions such as stress and depression. Improved mood
Coping ability	17% [93,116,117,120,123–125,128,136,138,140,141,150]	7% [130]	The ability to successfully deal with difficulties by trying to master, minimize or tolerate them
Awareness	11% [16,116,117,119,122–125]	16% [55,81,94,156]	Methods used to deal with stressful and unpleasant situations
Quality of life	10% [86,122,123,126,127,136,147]	3% [156]	An assessment of how the individual's well-being may be affected over time by a disease, disability, or disorder.

Self-confidence	6% [16,79,138,150]	3% [95]	A feeling of trust in one's abilities, qualities, and judgment
Physical health	6% [21,142,147,153]	7% [95,133]	Fatigue, disability, pain, having a physical symptom
Health behavior	3% [117,127]	0%	Beliefs and actions about health such as complying with physicians' advice and taking medication based on instructions.
Others	13% [19,79,116,118,121,138,139,143,149,152]	13% [54,134,145]	Mixed outcomes, no significant association
Not mentioned	1% [137]	6% [57,129]	-

Community Platforms

Although social networking sites are widely used, only 3% of the studies used this platform. One reason for this could be that forums are organized into specific subjects and patients can find their peers and benefit from peer support more easily. Also, forums can create a discussion environment by saving any information posted on a certain topic for other patients to see at any time. As such, patients can have the time to think about and research the topic and participate in high quality discussions. On the other hand, social networking sites are organized among one's previously established network and interests. Thus, it might be difficult to find peers in social networking sites. Last but not least, only 2% of the studies used microblogging as the platform.

Table 8As shown in Table 8, five types of platforms were identified. Sixty two percent of the studies used the offline community platform. However, online community platforms are used in 38% of the studies. Among online community platforms, forums were used the most (21%). Other types of platforms were social networking sites (3%), other types of online communities such as computer mediated platforms (10%), or not specified (2%). Although social networking sites are widely used, only 3% of the studies used this platform. One reason for this could be that forums are organized into specific subjects and patients can find their peers and benefit from peer support more easily. Also, forums can create a discussion environment by saving any information posted on a certain topic for other patients to see at any time. As such, patients can have the time to think about and research the topic and participate in high quality discussions. On the other hand, social networking sites are organized among one's previously established network and interests. Thus, it might be difficult to find peers in social networking sites. Last but not least, only 2% of the studies used microblogging as the platform.

Table 8: Synthesis of the Results: Community Platforms

Platforms	Percentage	Description
Offline	62% [16,17,19,21,79,85,86,93,116–127,135–143,146–151,153]	Offline support groups

Online (38%)	Forum	21% [20,54,56,57,95,129–134,144]	Designed for threaded discussions about specific subjects and sub-subjects. People follow the topics that they are interested in and create thread of discussions.
	Social networking sites	3% [81,155]	Personalized online community around one's interests. People are often held together by pre-established interpersonal relationships.
	Microblogging	2% [154]	Making short and frequent posts to a microblog such as Twitter
	Other	10% [53,55,94,145]	Online communities such as website, mailing list, computer mediated support group
	Not mentioned	2% [156]	-

Online Community Features

Features of the online communities that were used include public discussion (37%), group messaging (41%), or private messaging (7%). Fifteen percent of the studies did not specify any feature. See Table 9. Public discussion and group messaging are among the most used features. One reason for these results could be that in large groups the diversity of experiences is higher, patients have higher chances of finding similar others.

Table 9: Synthesis of the Results: Online Community Features

Online Community Features	Online	Description
Public discussion	37% [54–57,81,95,130,131,133,134]	Messages are public and can be seen by all community members
Group messaging	41% [53,55,94,129–131,144,145,155]	Messages are only accessible to a group of community members
Private messaging	7% [133]	Messages are shared between two peers
Not mentioned	15% [20,132,156]	-

Our Proposed Framework

As shown in Figure 7, breast cancer patients use different types of support. Also, the left and bottom bars show continua where one side indicates the most prevalent factors in offline communities and the other side indicates the most prevalent factors in online communities. Those factors that are less reported in the selected studies are placed in the middle of the continua where the color fades. For example, informational support is the most prevalent type of support in offline communities, while emotional support is more reported in online communities. Moreover, tangible and decision making support are both less reported than other types of support in offline and online communities. However, tangible support is more prevalent in offline communities. Hence, it is closer to the upper side of the continuum. While most of the studies reported the type of support, there are still about 19% and 18% of the studies in offline and online communities, respectively that did not mention the type of support.

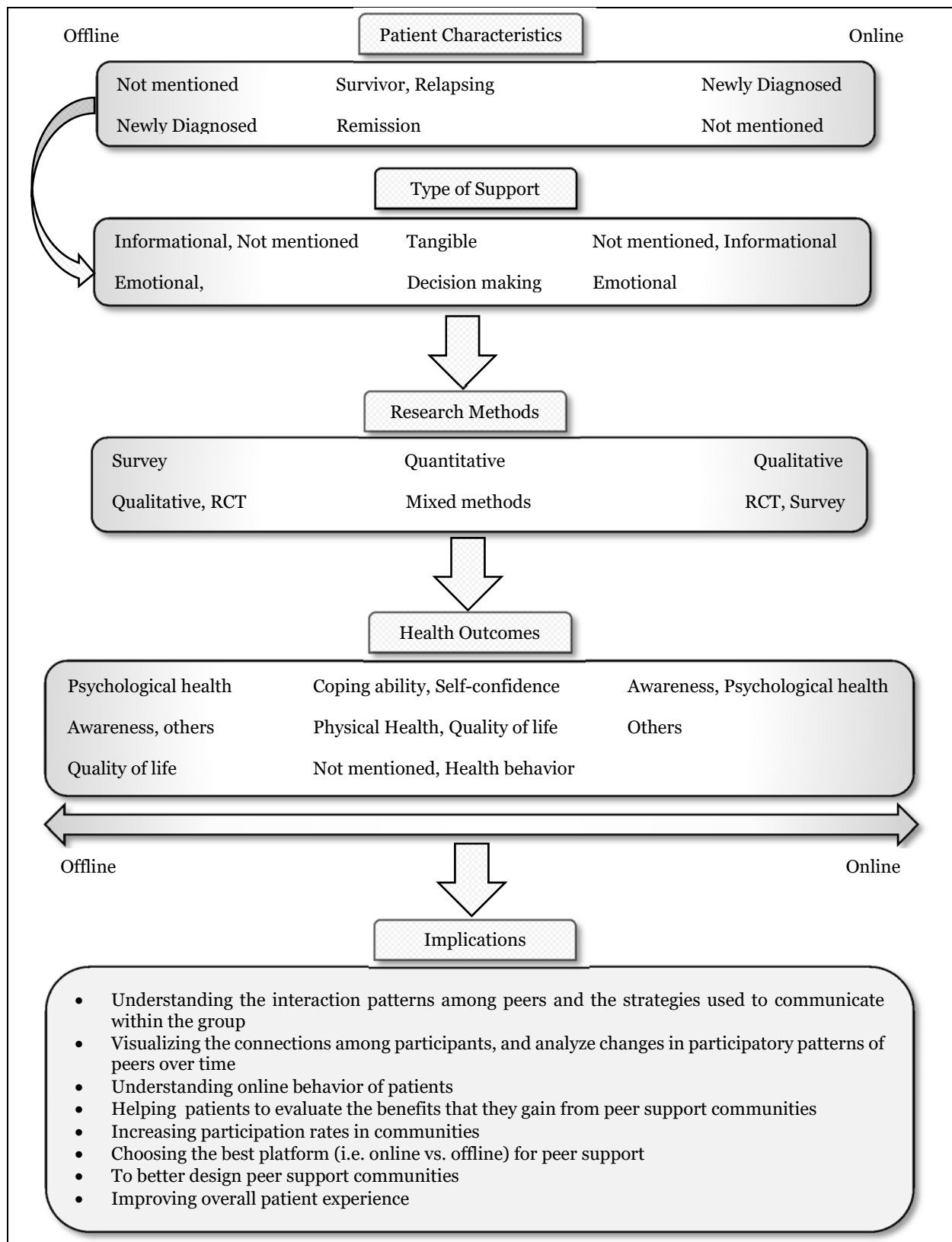


Figure 7: Comparing Peer Support in Offline and Online Communities

Discussion

Peer support for breast cancer patients has been widely recognized to improve various psychological and physical outcomes. Breast cancer is the second most common type of cancer for women in the United States [18]. Breast cancer patients often are faced with physical, psychological, and social difficulties following their diagnosis. Hence, they use peer support communities as an effective platform to achieve positive health outcomes. While offline peer support communities have been extensively studied in the past, online communities recently gained attention as a new tool to support breast cancer patients. This study has focused on comparing peer support in offline and online communities for breast cancer patients. We proposed a framework to understand better how offline and online communities are used and what their impact on breast cancer patients are. We believe that our use of prior frameworks and measures [98,99,106,107] increases the relevance and generalizability of our findings. We adapted four frameworks [98,99,106,107] to code our data and frame the results into seven categories including types of support, patient characteristics, regions of the study, research methods, health outcomes, community platforms, and online community features.

To address our first research question regarding the similarities and differences between offline and online peer support communities for breast cancer patients, we compared types of support, patient characteristics, research methods, and regions of the studies. In terms of types of support, emotional and informational support are the main types of peer support in both communities. However, decision making support emerged as a new type of peer support from our coding process. It is intended to help patients in making some healthcare decisions by seeking their peers' advice. This type of support is often used in

online communities and enhances key patients' communication skills such as information seeking and question asking. Generally, in informational support, patients share information regarding their health issues, but it does not necessarily lead to making a health decision. For instance, they can share information about the steps of treatment and diet options. However, decision making support is focused on problem solving and making a health decision such as which treatment option to choose, or which diet to follow. Hence, patients can make decisions that are in line with their preferences, values, and needs [110,160].

Our findings show that decision making peer support is more prevalent in online communities. Hence, we can argue that patients are using crowdsourcing among their peers and try to shed light on their complex health problems and make some health decisions. As online communities enable people to take advantage of crowdsourcing, the idea of crowdsourcing for solving health problems has been recently proposed [161,162]. Crowdsourcing can be defined as sourcing a task or problem to a large and undefined network of people in the form of an open call via the Internet [163]. In this mode of sourcing, the work is divided among participants to achieve a cumulative result. Hence, using the knowledge of the crowd instead of few experts [163]. On one hand, crowdsourcing can be misleading for patients who rely on the opinions of non-experts for health decisions. On the other hand, enhancing patient engagement by empowering patients to be more involved in research and their own care can lead to better health decision making. One well-established example is PatientsLikeMe, a global patient network of patients. Within this platform, patients connect with others who have the same disease or condition to track and share information about their experiences. As patients

are using online communities to make health decisions, future research is needed to study their benefits, risks, and impacts on patients in order to better serve patients' decision making needs. It is also interesting to investigate why despite the warnings of healthcare professionals about the misinformation on online communities, patients still choose to use such communities to make health decisions.

As far as our first research question is concerned, we further identified patient characteristics. Newly diagnosed patients constitute the majority of the population in both offline and online communities. This shows the need to develop stronger peer support groups to address the needs of newly diagnosed breast cancer patients. Newly diagnosed patients often are overwhelmed with all the information they are getting and the choices they are being asked to make. They are distressed and have a lot of questions about what they will face in the future. Organizers of peer support communities can develop early interventions that may be followed by healthcare professionals to better address informational and emotional needs of newly diagnosed patients such as reducing psychological distress. Nonetheless, 26% and 64% of patient characteristics are still unknown in offline and online communities, respectively. Currently, it is unclear whether patients did not disclose their characteristics, or the studies did not report them. Future studies can shed light on this matter.

Regarding our first research question, our research results showed that survey, randomized control trials, and qualitative methods were mainly used to study peer support in both offline and online communities. However, social network analysis was not used in any of the selected studies. An avenue for future work can be to use this

method for studying the social structure and interaction patterns among peers, and analyzing changes in participatory patterns of peers over time.

To address our second research question regarding the main outcomes of participating in peer support communities for breast cancer patients, our scoping review reveals that improved psychological health was the most reported outcome in both communities. However, online communities appear to be more effective in enhancing patients' psychological health. One reason could be that patients can anonymously participate in online communities and thus may feel more comfortable to express their psychological needs and receive peer support. Nonetheless, further research is required to answer why online communities are more successful in enhancing psychological health. Other important outcomes include improved coping ability and awareness. Based on our results, we can argue that if patients are looking to improve their psychological health and awareness, using online peer support communities is a more effective option. However, offline communities are more effective in improving their coping skills and quality of life. Designers of peer support programs and online platforms can also identify and enhance the features that leads to those outcomes. Thus, improving overall patient experience in peer support communities.

As participating in online and offline communities seem to be leading to different health outcomes in some areas, patient can use the communities that is more aligned with their preferences and needs. Indeed, using both communities can maximize the outcomes. On the other hand, few of the online communities reported other outcomes (i.e. mixed outcomes) such as both increased and decreased emotional well-being. Talking about their own disease and [159], or having low emotional competence [145] was identified as

underlying reasons for such mixed outcomes in online communities. Thus, more research is required to investigate this issue.

Our results also indicate that studies did not use all the available platforms to examine peer support for breast cancer patients. For instance, among the online platforms, only 2% of the studies has used microblogging as its platform. More research is required to examine the impact of using microblogging on patients. For example, hashtags can help patients find engaging content from others on the topics of their interest. This makes the process of content curation on Twitter much more effective. Moreover, as patients are increasingly using online platforms [107], further research is needed in this area. Group messaging and public discussion were among the main features that breast cancer patients used to provide and receive peer support. One reason for this could be that in large groups patients have higher chances of finding similar others. Table 10 includes future research agenda and implications according to our seven categories.

Table 10: Future Research Agenda

Category	Suggested Research Question(s)	Implication(s)
Type of Support	<ul style="list-style-type: none"> • How patients are using online peer support communities for healthcare decision making? • What are the benefits and risks of online peer support communities for patients? • How online peer support communities impact patients' decision making? • Why patients use online peer support communities for decision making? 	<ul style="list-style-type: none"> • Understanding patients' decision making rationale, benefits and risks • To better serve patients' decision making needs
Patient Characteristics	<ul style="list-style-type: none"> • What are the informational and emotional needs of newly diagnosed patients? 	<ul style="list-style-type: none"> • To better address informational and

	<ul style="list-style-type: none"> • How to develop early interventions in peer support communities to better address informational and emotional needs of newly diagnosed patients? 	emotional needs of newly diagnosed patients
Research Methods	<ul style="list-style-type: none"> • How the interaction patterns among patients in peer support communities change over time? 	<ul style="list-style-type: none"> • Understanding the interaction patterns among peers and the strategies used to communicate within the group • Visualizing the connections among participants, and analyze changes in participatory patterns of peers over time • Understanding online behavior of patients
Health Outcomes	<ul style="list-style-type: none"> • Why online peer support communities are more effective in enhancing psychological health of breast cancer patients? • Why online peer support communities can both increase and decrease psychological health outcomes? 	<ul style="list-style-type: none"> • Helping patients to evaluate the benefits that they gain from peer support communities • Increasing participation rates in communities • Choosing the best platform (i.e. online vs. offline) for peer support • To better design peer support communities • Improving overall patient experience
Platforms	<ul style="list-style-type: none"> • What are the impact of using microblogging for peer support on breast cancer patients? • Why despite the warnings of healthcare professionals about the misinformation on online communities, patients still choose to use such communities to make health decisions? 	<ul style="list-style-type: none"> • Evaluating the effectiveness of microblogging platform for peer support • Comparing microblogging platform with other platforms and find an optimal platform • Benefits and Risks of online communities

Platform Features	<ul style="list-style-type: none"> • Why and how patients use group messaging and public discussion were as the main features to provide and receive peer support? • Designing more effective platform features
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Conclusion

The framework we proposed in this scoping literature review provides a portrait on the current evidence regarding the comparison between online and offline peer support communities for breast cancer patients. It contributes to more informed peer support community selection and use by breast cancer patients. The findings of this study can be used by organizations to guide the specific use strategies that provide the maximum benefits from both offline and online communities. From an academic perspective, this literature review can provide an overview of existing work regarding peer support for breast cancer patients, identify main elements of peer support for breast cancer patients as studied in extant literature, compare and contrast two main peer support platforms (i.e. offline and online communities) vis-à-vis the main peer support elements, identify gaps and provide future avenues for research for each identified peer support element. From a practical perspective, this study can enable healthcare professionals and breast cancer patients to better understand the structure of online peer support and help patients to use online communities as an effective platform to find similar others and improve their psychological health. Breast cancer patients can be encouraged to join peer support communities and subjectively identify with these groups to have higher satisfaction with life, lower degrees of anxiety and depression. Patients find providing and receiving emotional and information support in peer support communities helpful since they believe similar others can understand their situation and validate their feelings.

Chapter Three: Essay #2 - Apparatuses of Knowledge Delivery and Their Impact on Each Other: The Role of Online Communities in Vaccine Controversies

Introduction

In recent years, practices of knowledge delivery in online communities have been growing in salience as more people are joining and sharing their experiences online [4,164]. In the shift to knowledge delivery in online communities, traditional practices of knowledge delivery are challenged as people are exposed to opposing beliefs, scientific and non-scientific evidence, and emotionally arousing stories of others [9]. The abundance of inconsistent information coupled by emotionally arousing experiences of others in online communities, can lead people to question the credibility of the provided knowledge [7]. In such communities, people increasingly challenge the way knowledge is constructed, the people who hold knowledge, and the way knowledge is being delivered [9]. Hence, scrutinizing the role of online communities to understand how they change the established ways of knowledge delivery and to identify the consequences of such changes becomes significant.

While there has been considerable research interest in knowledge delivery and its underlying mechanisms [4,165,166], we currently know little about what happens when knowledge delivery occurs in online communities. We aim to address this gap by conducting a qualitative study in healthcare knowledge delivery domain. We deemed this context as appropriate and revealing for two reasons. First, the practice of knowledge delivery to patients is one of the most important aspects of health care. Healthcare

professionals are continuously in the process of providing knowledge including information about health conditions and explanations about the consequences of health decisions to their patients [167]. Knowledge delivery by healthcare professionals is rooted in expert knowledge, several years of field experience, and patient's medical history [168]. Second, with the extensive use of online communities in recent years, patients can now easily obtain healthcare knowledge via online communities [7], which affects the very knowledge delivery process. Hence, healthcare provides a suitable context to study what happens when knowledge is delivered in online communities by anonymous users instead of experts. A relevant case in point is vaccine knowledge delivery in online communities that has fueled the existing controversies around vaccine administration, known as the anti-vaccination movement questioning the legitimacy of vaccine knowledge delivery provided by healthcare professionals [7,169]. As a small but increasing number of people refuse to vaccinate their children, several infectious diseases can spread at higher rates and lead to higher morbidity and mortality rates from infectious diseases [7,39] as it happened with Disneyland measles outbreak [40].

We use material-discursive practices as our theoretical lens to study knowledge delivery practices in offline and online community environments. Material-discursive lens enables us to understand how knowledge delivery is accomplished in practice through trained professionals, written instructions, publicly accessible Internet, and online platforms. Moreover, this lens allows us to focus on the constitutive entanglements of humans and technologies and study performative outcomes of knowledge delivery practices [170]. Prior work [170] has shown that in material-discursive practices, discourse is materially expressed in bodies, things, instruments, texts, times, and places. Also, such practices can

have performative outcomes reconfiguring the processes and outcomes of the organizations [35]. However, our knowledge is limited regarding the influence of different material-discursive practices on each other. We argue that with new forms of technological collaboration, often there are more than one material-discursive practice at work. Different practices can produce different and sometime conflicting performative outcomes for organizations. As such, understanding the influence of different material-discursive practices on each other and on organizations becomes significant. To fill this gap, we contribute to material-discursive perspective by conducting a qualitative study on offline and online community-based knowledge delivery practices.

The move to knowledge delivery in online communities is raising important questions about how knowledge delivery practices change when they are produced in online communities by the general public and what outcomes they generate for the people who access them. Accordingly, we address two research questions: “How does the use of online communities change the practice of knowledge delivery to people?” and “How do offline and online communities-based knowledge delivery practices influence each other?” To answer these questions, we will investigate two notable vaccine administration positions in the public health domain: pro-vaccination and anti-vaccination knowledge delivery practices first in offline interactions between patients and healthcare professionals, and second, in Facebook online communities on vaccination. The pro-vaccination movement is based on medical standards, approved clinical trials, jurisdictional policies and procedures to provide vaccine administration guidelines. However, the anti-vaccination movement draws on informal, user-generated content lacking rigorous scientific support. We use a grounded theory approach to analyze our data that is collected from the extant

literature and Facebook posts. This research will allow the identification of important differences in the offline and online community-based knowledge delivery practices and their outcomes. As healthcare organizations are confronting the anti-vaccine movement by providing recommendations, guidelines, and policies to encourage vaccination [171], this study aims to investigate the ongoing interaction and tension between traditional and new knowledge delivery practices. Using a material-discursive conceptualization of knowledge delivery, we aim at showing how knowledge delivery is materialized in certain ways and what its performative consequences for another apparatus are.

This study makes two contributions. First, we aim to provide a grounded understanding of the practices of knowledge delivery by empirically investigating these practices and their outcomes. We believe knowledge delivery in online communities goes beyond the expansion of the offline and standardized knowledge delivery practices, because online communities can provide equal opportunity to all perspectives and allow outlier and small extremist views the same space as scientifically approved ones [169]. Second, we add to the material-discursive theory [35,170] by showing how two different, yet related, apparatuses or material-discursive practices (i.e. offline and online communities-based knowledge delivery practices) influence each other. So far, we learned how the ongoing production of material-discursive practices or apparatuses can reconfigure processes and outcomes that are produced in organizations [35]. However, we argue that in addition to reconfiguring organizational processes and outcomes, at any given time and place, an apparatus can lead to enactments in another apparatus through changing its materialization within specific activities, instruments, measures, texts, and media.

Literature Review

In this section, we provide an overview of the existing literature on general knowledge delivery practices in offline interactions and in online communities. Knowledge delivery embeds the sharing, transfer, accumulation, and transformation of knowledge by individuals [172]. The knowledge delivery practice has been studied in different contexts such as organizational learning, education, decision making, and health care. Health care is of particular relevance to our study, as the process of knowledge delivery change extensively across contexts. Before delving into knowledge delivery practices in health care, we discuss situated knowledge in practice as the literature on community of practice is helpful in examining how knowledge and learning is shaped by different activities within a practice [173–176].

Situated Knowledge in Practice

Knowledge is identified as situated with a purposive nature which is created by a community of individuals who have a shared practice [173]. Thus learning in the sense of making a shared decision between a physician and a patient includes learning patient's medical profile and personal preferences as well as the ability to apply them appropriately to make the final decision. Such a conceptualization of knowledge acknowledges the difference between “knowing how” and “knowing that”. “Knowing how”, the way of doing the practice, is tacit in the practice. “Knowing that” is obtained by explicit codified information. “Knowing how” helps to make knowing that actionable. However, accumulation of “knowing that” does not lead to “knowing how” because “knowing how” is learnt by practice. As [177] states:

“Transforming knowing how into knowing that, the tacit into its nearest explicit equivalent, is likely to transform learning from learning to be into learning about.”

“Knowing that” is the ability to obtain information from different resources, but not necessarily to apply that knowledge in the practice. “Knowing how” is the art of practice [177] much of which lies tacit in a community of practice. The distinction between “knowing how” (situated knowledge) and “knowing that” suggests that a shared syntax is not enough, but there is a need for situated knowledge. Thus, knowledge and knowing cannot be separated from individual engagement in the practice. Even a rigorous “know that” is not enough to guide the enactment at any moment in the practice, the dynamics of the practice assign new meaning to the codified know that [174]. Thus dynamics of the moment should be analyzed to be able to deliver knowledge effectively.

From a practice-based perspective, knowledge and organizations are intertwined. Knowing is achieved through practice where know how is enacted and agency is applied [175]. Thus knowledge in organizations is situated in social context of the practice. Knowledge delivery includes discourse which enables the connection between the source and the recipient of knowledge. Such knowledge is constructed within practice rather than passively recorded via other resources. Knowing in practice is continually enacted through ongoing action [174]. Knowing is an ongoing social achievement, constituted and reconstituted in everyday practice. Several scholars have applied the dynamic view of knowledge production that is recurrently enacted in practice in their research on knowledge in organizations [4,173,178–180].

Knowledge paradoxes arise by confusing knowing how and knowing that or by assuming that one can be substituted for the other without problems [177]. To be able to describe what people know is different from how they come to know it. Moreover, the interpretations of codified knowledge depend not on the content, but on the individual making the interpretation. In different practices, the same knowledge is used in quite different ways in different settings. Consequently, much effort is invested on learning to decode the content within the practice. Thus, knowing how is achieved through the practice [179].

The notion of site introduced in prior work [175] contributes to the relationship between the practice and 'know how'. As know how is achieved via practice, the practice is considered as an instance of knowing which focuses on the moments of practice when know how is present in the practice. The idea of site makes the connection between know how and practice more visible. Site is the locality where something happens or exists in relation to other events and phenomena.

Knowledge Delivery Practices in Health care

One of the most important aspects of health care is the practice of knowledge delivery to patients about their health conditions and the consequences of decisions [31,165]. Knowledge delivery to patients or educating them by healthcare professionals has been studied extensively from two different perspectives. One perspective focuses on healthcare professionals in improving their abilities to understand patient histories and concerns, and inform patients about their conditions and treatment requirements to achieve successful diagnosis. Several studies have been conducted in this regard, looking at education agenda and levels, patient participation, privacy and reliability concerns,

social and cultural barriers [181], and educational materials [167]. The latter is particularly relevant to this study.

A second perspective focuses on the conflicting interests between patients and healthcare professionals. In the past two decades, as patients had access to online/offline medical information resources, some challenges have been created in their relationships with healthcare professionals [69]. Traditionally, healthcare professionals informed patients about their illnesses and treatments only as much as they assessed is sufficient for the patients. However, physician-patient relationship has rapidly moved away from a paternalistic approach to patients and toward focusing on patient autonomy and authority over their health conditions [182]. A remarkable example is the anti-vaccine movement where several sources of non-scientific information about the adverse effects of vaccines are available. As a result, some parents question the validity of physicians' knowledge by refusing to take their children for vaccination. Such movements are said to have contributed to a significant increase in preventable diseases including measles, putting lives of many in danger [7].

Knowledge Delivery Practices in Online Communities

Knowledge delivery and information sharing are key in the sustainability of online communities. In such communities, knowledge delivery occurs among anonymous individuals with different backgrounds and interests often in the form of publicly available posts and comments [7]. Knowledge delivery in online communities is inherently interactive and patient-driven in contrast to offline knowledge delivery practices where healthcare professionals are considered as experts and patients trust and follow their advice [22]. Knowledge delivery is a key factor in the life of online

communities as the shared knowledge not only can benefit individuals, but also add to community's greater value [172]. For example, the Mayo Clinic Center for Online communities delivers general healthcare knowledge to people via their page on Facebook. It contributes to health and well-being of patients by educating people about their health. Similarly, "Patientslikeme" is a health related online community that enables knowledge delivery and information sharing among patients. It aims to transform the way patients manage their own conditions, changing the way industry conducts research, and improve patient care. There are however, potential risks in knowledge delivery in online communities. For example, when individuals with vague social identities share partial information about their medical experiences, they are not always accountable for their actions [159,164]. Moreover, individuals may have competing interests, when they are sharing knowledge in online communities. The lack of availability of information for triangulation is another area of vulnerability for knowledge collaboration in online communities [154,183,184].

While online communities provide a useful platform for knowledge delivery, they blur the line between the consumption and production of knowledge [171,185]. In other words, healthcare knowledge delivery has always been bound to standardized guidelines and approved medical trials by the scientific community. However, substantial misinformation is broadly available in online communities, which makes it difficult for patients to distinguish knowledge from misinformation [88]. To fully comprehend this issue and examine how knowledge delivery practices are changed when they go to online communities, we study offline and online vaccine knowledge delivery practices and vaccine controversies that are currently heightened by online communities.

Theoretical Underpinnings

In this section we draw on [186] to explain the different theoretical views used in IT extant literature for studying technology. We further discuss why we chose material-discursive practices as a lens for our study, and how we aim to contribute to this line of research.

Different Theoretical Views on Studying Technology

In extant literature, four conceptual perspectives on technology have been discussed [186]. In the first category, technology is characterized as “absent presence”, meaning technology is unacknowledged and unaccounted for in these studies although it is present in their contexts. In the second category, technology is considered an “exogenous force”, meaning it has determinate impacts on human behavior and organizations. Unlike the first category, in “exogenous force” category, technology is acknowledged and is seen as hardware that is separate from humans and organizations and directly impacts them. In the third category, technology is considered as “emergent process”, meaning it is a product of ongoing human interpretations and interactions. Technology is here understood as material artifacts that are socially defined and socially produced, and thus as relevant only in relation to the people engaging with them. This perspective has been influenced by different schools of thought including socio-technical systems [187], social construction of technology [188] and structuration theory [189]. Second and third categories share an underlying core presumption that technology and humans are essentially different and separate realities. These perspectives share a simple dualistic view of agency which claims that agency is located either in the human or in the technology artifact.

In line with the third category, practice-based approach to studying technology has been introduced [190]. This approach goes further from considering technology as “emergent process” and highlights the consequential dynamics of technology use as well [191,192]. Practice-based approach views phenomena as produced in everyday action, as organized around shared practical understandings, and as enacting particular structural orders. However, because practice-based studies focus more on human activities in their analyses, they tend to overlook the constitutive role of technology in producing phenomena. More useful for our purpose is material-discursive practice or a relational view that privileges neither humans nor technologies, but focuses instead on their *constitutive entanglements* and *performative consequences* [170,193]. In the following we will further elaborate on this perspective and consider it as the fourth category for studying technology.

Rooted in quantum physics and following the Bohrian approach to epistemology [194], the fourth category is “entanglement in practice” which commits to a relational ontology that undercuts the dualism that has characterized the second and third categories. In the entanglement perspective, the social and the material/technical are posited to be ontologically inseparable from the start and the starting place comprises configurations of always already interrelated, reiterated sociomaterial practices. Examples of entanglement perspective are actor network theory [195] and sociomateriality [170]. In sociomateriality, “the social and the material are considered to be inextricably related — there is no social that is not also material, and no material that is not also social” [196].

The entanglement perspective argues for a *performative* practice that

“Shifts the focus away from ‘independent objects with inherent boundaries and properties’ to practices, matters of doings/actions that perform particular phenomena. Phenomena, on this account, are ‘ontologically primitive relations—relations without preexisting relata’ that are enacted in material-discursive practices (Barad, 2003, p. 815). From such a *performative* perspective, technologies have no inherent properties, boundaries or meanings, but are bound up with the specific material-discursive practices that constitute certain phenomena. In contrast to the ‘Cartesian cut’ that enacts a determinate ontology, Barad (2003) argues for ongoing and dynamic ‘agential cuts’ that *perform* and stabilise/destabilise particular distinctions, boundaries, and properties within phenomena in practice.” [186], page 13.

The notion of apparatus refers to the specific material-discursive practices that help constitute phenomena through producing knowledge about them. Barad argues that the observed object (e.g. technology) and agencies of observation (i.e. apparatuses) are inseparable.

“Given particular methods of observing, measuring or examining a phenomenon, certain properties of that phenomenon will become determinate, whereas others will be specifically excluded (Barad, 2007, p. 20). On this view, apparatuses are boundary-making practices that focus agencies of observation on one thing instead of another. Rather than regarding empirical findings as a mirror or lens through which we can see reality, findings are read through the apparatus” [197], page 6.

Table 11 provides a summary of different perspectives for studying technology.

Table 11: Different Perspectives for Studying Technology

No.	Category	Description
1	Absent presence	Technology is unacknowledged although it is present in their contexts
2	Exogenous force	Technology is acknowledged and is seen as hardware that is separate from humans and organizations and directly impacts them
3	Emergent process <ul style="list-style-type: none"> Practice-based approach 	<p>Technology is here understood as material artifacts that are socially defined and socially produced, and thus as relevant only in relation to the people engaging with them.</p> <ul style="list-style-type: none"> Technology is here understood as material artifacts that are socially defined and socially produced. The focus is on human activities and the consequential dynamics of technology use.
4	Entanglement in practice (or material-discursive practice)	The social and the material/technical are posited to be ontologically inseparable from the start and the starting place comprises configurations of always already interrelated, reiterated sociomaterial practices. The focus is on constitutive entanglements and performative consequences.

As the entanglement perspective removes the dualism between social and material, it offers the potential to radically re-conceptualize the notion of technology and reconfigure our understandings of technology and organizations.

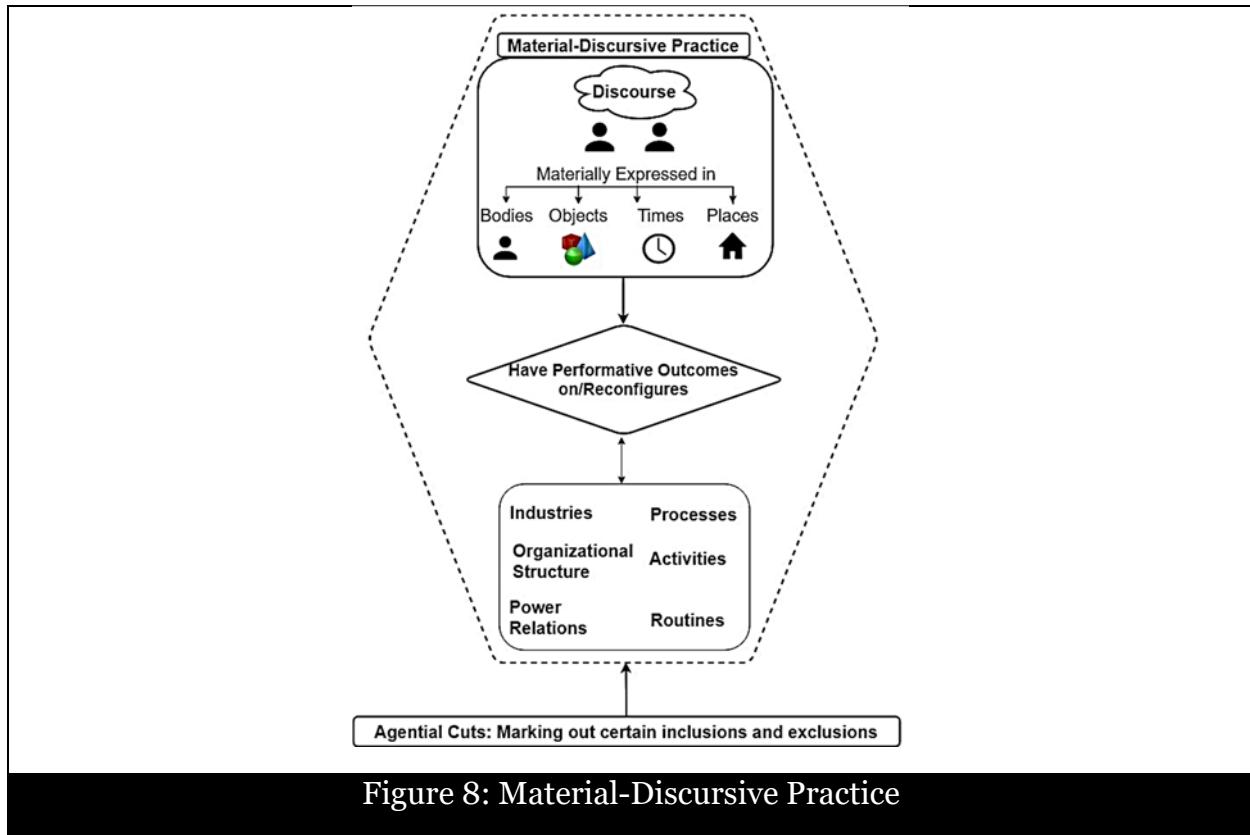


Figure 8 provides an illustration of material-discursive lens. As discourse is materialized in bodies, objects (e.g. texts, instructions, measurements, etc.), times, and spaces, material-discursive practices are formed. Such practices have performative outcomes for (or reconfigure) organizational structures, process, routines, and power relations. The different materializations and local enactments produce different kinds of practices and outcomes. Hence, material discursive practices are boundary-making work that create agential cuts. Agential cuts are local enactments that mark out inclusions and exclusions and make certain properties determinate-in practice. Identifying what is included in and excluded from consideration is important for understanding the phenomenon and what is potentially available for re-expression, respectively [35,170]. For example, knowledge delivery in online communities produced through anonymous emotional-arousing

personal experiences and with insignificant scientific support, will differ substantially from that produced by formally trained healthcare professionals through written instructions during patient visit.

Our Contribution to Material-Discursive Practices

Our overall goal is to take a step further and add to material discursive practices view by accounting for the influence of different material-discursive practices on each other. So far, we learned about the entanglement of social and material and their performative outcomes in studying technology. However, these studies examined different material-discursive practices in isolation [196], while in many cases, material-discursive practices are used simultaneously and are continually reconfigured. As Barad [170], page 817, notes:

“This ongoing flow of agency through which “part” of the world makes itself differentially intelligible to another “part” of the world and through which local causal structures, boundaries, and properties are stabilized and destabilized does not take place in space and time, but in the making of spacetime itself are *reconfigured* [emphasis added], once they are configured.”

Such understanding is a critical part of the phenomenon as it helps us to capture how performative outcomes of one practice can reconfigure local causal structures, boundaries, and properties of another practice. As material-discursive practices have performative outcomes, they can have an impact and reconfigure another practice through their ongoing, dynamic, relational enactments. Hence, by accounting for the intra-actions between practices, we can explain how local causal structures, boundaries, and properties are destabilized after a period of being stabilized.

We conduct a qualitative study regarding vaccine administration, where the practices of knowledge delivery and peer interactions in online communities have created distrust in the credibility of the medical field and offline knowledge delivery practices. As shown in Figure 9, we propose that not only the agential cuts of knowledge delivery to patients are different in offline and online communities-based settings, but also that they influence each other via their performative outcomes. For example, when healthcare officials became aware of the consequences of misinformation in online communities that lead a group of people to refuse vaccinating their children, they enacted a legislation and mandated vaccine administration for every child who attends school. On the other side, anti-vaccine communities have started to protest against this new law. Although the anti-vaccine movement predates the broad use of online communities, such communities have a significant role in disseminating the anti-vaccine views to a larger group of people and enable anti-vaccine activists to interact remotely, make collective decisions, and organize protests [7].

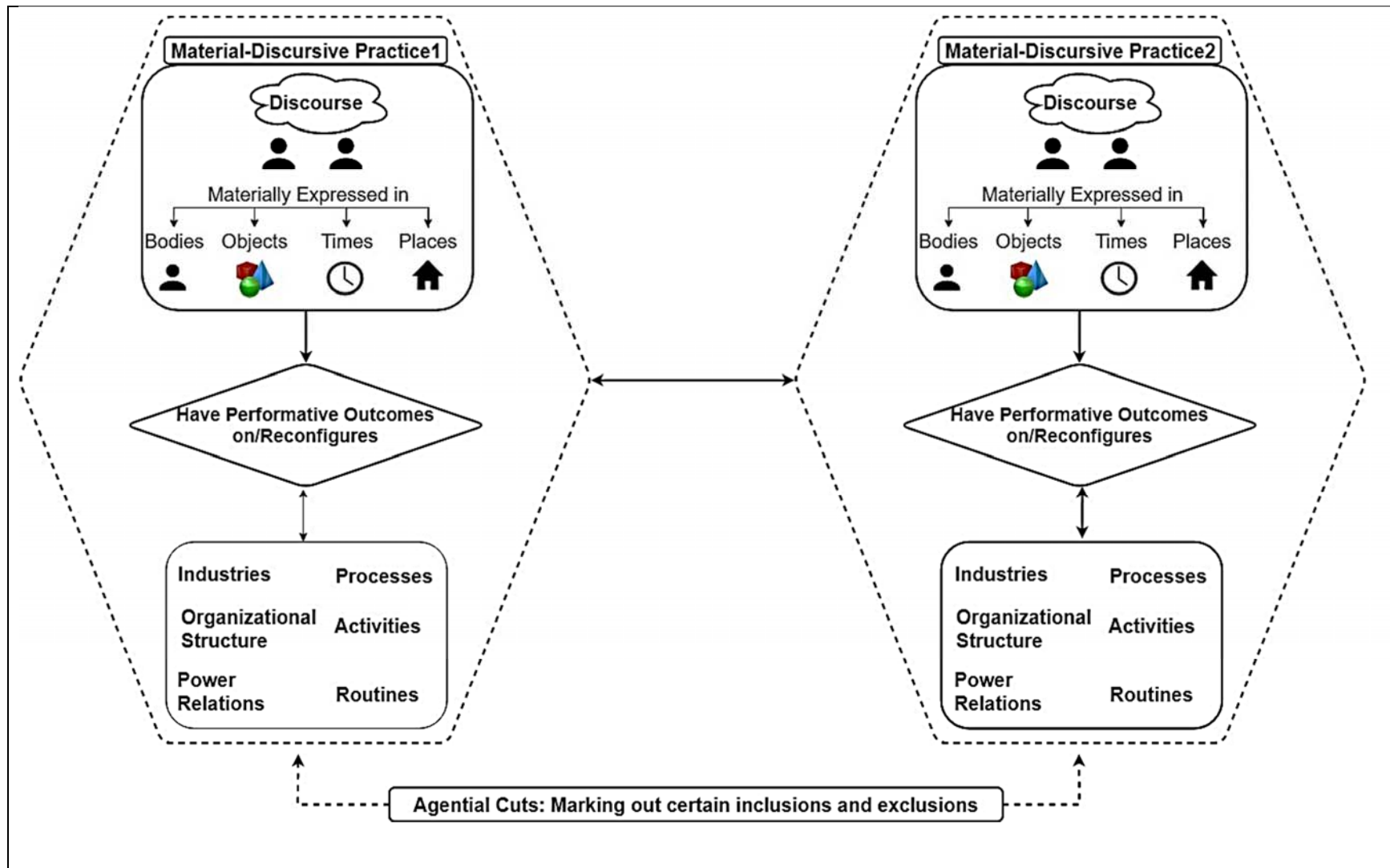


Figure 9: Influence of Material-Discursive Practices

Methodology

In this section we further discuss the application of our theoretical lens in our analysis. Next, we elaborate on our context, data collection, and data analysis processes.

Material-Discursive Practices as a Lens for our Study

Material-discursive practices or apparatuses are defined as “specific iterative enactments—agential intra-actions—through which matter is differentially engaged and articulated” [198], page 87. They highlight how meaning and matter are entangled in that meaning is not a property of individual words, rather it is through particular agential intra-actions that the properties of the “components” of phenomena become determinate and that particular embodied concepts become meaningful. Thus there is no predefined reality to be interpreted. In material-discursive view of the phenomenon, no priority is given to either materiality or discursivity as there is no causal relationship between the two, but rather an iterative materialization.

Although there are separations among different phenomena, each phenomenon and our interpretations of it are inseparable and are contingent on their relations within material-discursive practices [35]. The notion of apparatus underlines the inseparability of the device from what is observed. Apparatuses are productive and part of the phenomenon as they enact what matters and what is excluded from mattering (i.e. agential cuts). Considering knowledge delivery as material-discursive practices or apparatuses enable us to depart from viewing specific activities, text, and artifacts as the means to transfer knowledge, and study how knowledge delivery practices are being materialized within specific forms (e.g. activities, text, and artifacts).

Adopting material-discursive practices as our theoretical lens allows an in-depth study of offline and online communities-based knowledge delivery practices. Indeed, apparatuses are constituted through specific material-discursive practices, their agential cuts, and their performative outcomes. We examine the materiality of knowledge delivery, providing a way of explaining both how knowledge delivery is actively produced in ongoing practice and how such production is performative, reconfiguring the processes and outcomes of the knowledge being delivered to patients. Using this theoretical lens, we can investigate whether the knowledge and content transmitted in the two practices are the same, whether knowledge delivery to patients is a one-way process (i.e. suggesting patients as passive recipients of knowledge) or whether the intended recipients are patients speaking and making decisions on their behalf. Moreover, we will explore yet another interesting question that remains unanswered in the material-discursive view; that is how different apparatuses influence each other.

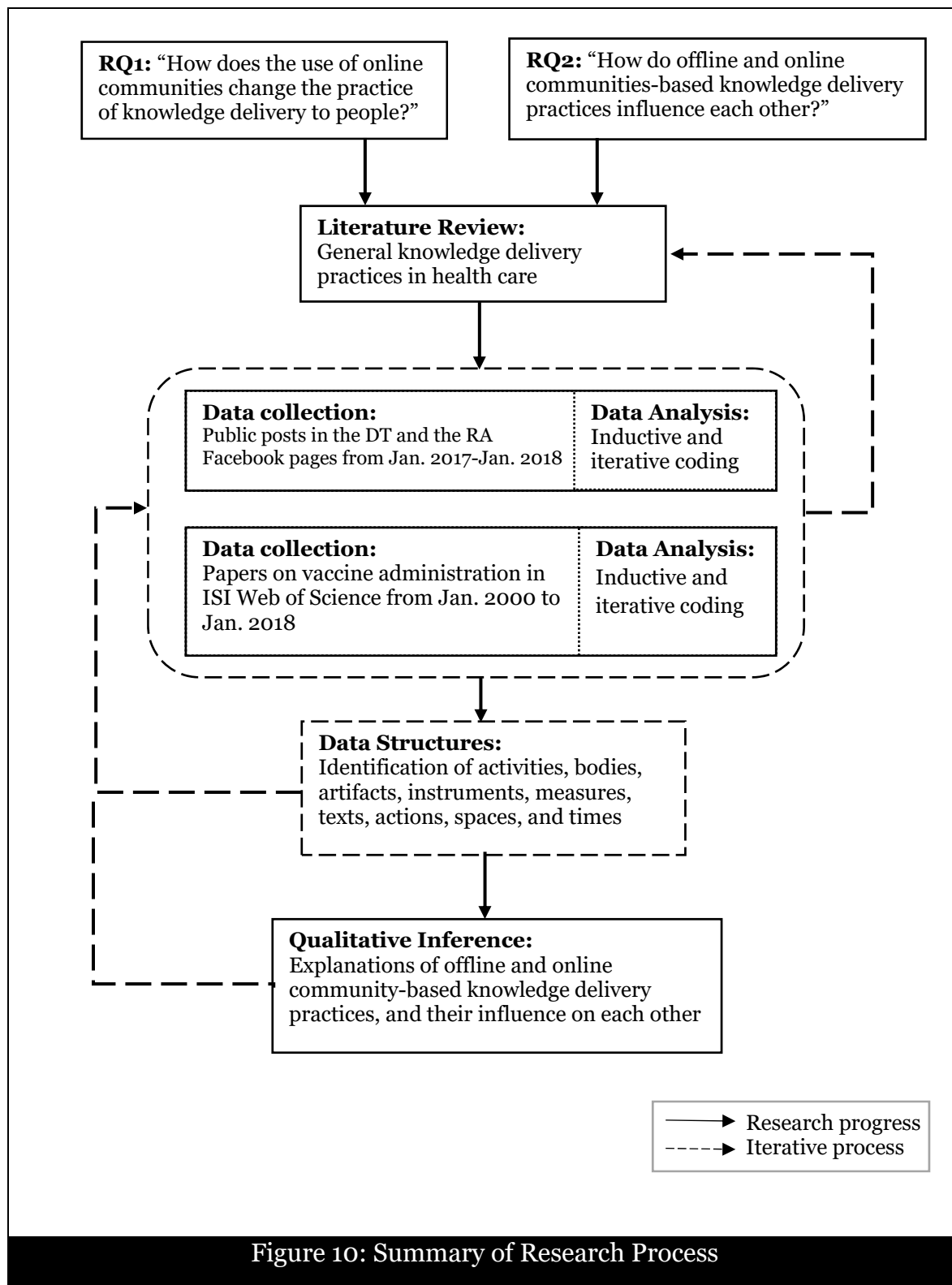
Understanding processes of knowledge delivery as material-discursive practices requires examining how the particular discursivity of knowledge delivery is materially expressed in practice. The specific activities, bodies, texts, and artifacts that are engaged in knowledge delivery are not merely mediators for delivering the intangible meanings or results of knowledge delivery. On the contrary, what the knowledge delivery is, at any given time and place, is what is enacted in practice through being materialized within specific forms (e.g., activities, devices, instruments, measures, texts, and media). Moreover, the specific materialization makes a difference to the kinds of knowledge delivery processes and outcomes that are produced. For example, knowledge delivery to patients through trusted expert-controlled websites will differ substantively from the

knowledge delivered by patient experiences posted often spontaneously and anonymously in online communities.

Vaccine Administration

Of all the branches of modern medicine, vaccinology can claim to be the one that has contributed most to the dramatic decline in morbidity and mortality rates from infectious diseases [7,39]. Vaccines are often known as a significant public health intervention, contributing to dramatic declines in morbidity and mortality. Nonetheless, ever since their introduction, there were skeptics who worried about the unknown risks of vaccination. While questioning vaccine safety is not new, the anti-vaccine movement has been going stronger since the premier British medical journal, the Lancet, published a study in 1998 linking a common vaccine (i.e. MMR) to autism. As several subsequent peer-reviewed studies have failed to show any association between the vaccine and autism, the journal retracted the study and its author was later barred from practicing medicine due to deliberate falsification in his research. Nonetheless, the notion of a vaccine-autism connection has been reinforced on media and in online spaces. The availability of numerous scientific and non-scientific online materials on vaccine controversies, peer communications in online communities, and individual interpretations, has had a substantial effect on the decrease in the public confidence in vaccination [169]. Doubting science however has some consequences. Some governments are cutting benefits for families who refuse to vaccinate their children. In some cases, non-vaccinated children cannot register at schools and day-care centres, as they are considered to put others' health at risk. To better understand knowledge delivery practices in offline interactions and in online communities, we collected our data from

extant literature. We also collected data from the posts in vaccine-related pages on Facebook to gain more insights into the knowledge that is shared in such communities. Our data collection from the literature is different from our formerly presented literature review. We focused on general knowledge delivery in the previous section, however, in our data collection we particularly focus on vaccine knowledge delivery. Figure 10, shows our research process.



First, regarding data collection from extant literature, we searched ISI Web of Science for papers on vaccine administration. Papers in English, published between January 2000 and January 2018 are considered. Three sets of keywords are searched in combination:

1. Vaccine administration (vaccination, anti-vaccination, vaccine movement, anti-vaccine movement),
2. Vaccine knowledge delivery (vaccine education, vaccine information),
3. Vaccine in online communities (Web.20, social networking sites).

Papers that focused on vaccine knowledge delivery in offline interactions and in online communities were included in our study. Moreover, papers that focused on offline knowledge delivery to patients by healthcare professionals, nurses, and pharmacists were included for data analysis. We considered all types of vaccines such as MMR, Rotavirus, Smallpox, and etc. in our data analysis. Papers that fell into “medical issues related to vaccination development” category were excluded from our data. In addition to scholarly papers, we included publicly available vaccination guidelines of Centres for Disease Control and Prevention (CDC) in our analysis. CDC is the leading national public health institute of the United States and aims to protect Americans from health, safety and security threats both foreign and in the U.S. As the nation’s health protection agency, CDC increases the health security of US citizens. To accomplish its mission, it conducts scientific research and provides health information that protects people against dangerous health threats and responds when these arise [199]. We browsed different

sections of the CDC website⁶ and collected relevant information regarding vaccine knowledge delivery.

Second, we also collected data from public vaccination and anti-vaccination online communities on Facebook, including the “Dr. Tenpenny on Vaccines and Current Events” (hereafter “DT”) and the “Refutations to Anti-Vaccine Memes” (hereafter “RA”) pages, where several people communicate and publicly share their knowledge with others regarding the benefits and risks of vaccines, especially for young children. Compared to similar pages in their domains, the DT and the RA have the highest number of subscribers indicating that these pages are very popular among patients to follow and contribute to vaccine knowledge delivery in online communities. The DT online community on Facebook was created in 2009 by Dr. Tenpenny, a medical doctor regarded as the outspoken physician on the negative impact vaccines can have on health. The DT claims to deliver credible, reliable information little reported in the mainstream media, combined with practical tips for natural health and healing. The DT administrator shares content on vaccine and patients participate in discussions by leaving a comment and/or reacting to another comment. On the other hand, the RA was founded in 2012 and claims to reveal the facts through text, memes, and refuting the lies and misinformation about vaccines. The RA posts sarcastic and serious memes, as well as factual articles and/or information about vaccines and the benefits they offer. Their purpose is to debunk and refute the anti-vaccination movement with text and memes. We selected the posts from January 2017 to January 2018 in both the DT and the RA pages and analyzed the post and comments related to each post that was shared by the administrators of the two pages.

⁶ <https://www.cdc.gov/>

We included the comments that are publicly shared and reflect personal views of the patients regarding the vaccination. We focused on the comments that reflect knowledge delivery practices. Those comment that only raise a question or contain content not relevant to vaccination or knowledge delivery practices were excluded from our analysis.

We followed the basic principles of grounded theory building [36], iterating between data and literature throughout the data collection and analysis. We take an inductive approach [200], guided by a commitment to a process that involves constant cross-checking among different data sources, and assessing and interpreting theoretical constructs against empirical data. We began with a grounded theory approach to analysing the data [36], informed by our focus on knowledge delivery practices, material discursive apparatus, and performative consequences while remaining alert to emerging ideas. As this study is exploratory, our process of data analysis was inductive and iterative, with the early stages being more open ended than the later ones. We cycled through multiple readings of the peer reviewed papers, online community posts, and archival documents. In our first round of coding, we focused on identifying two knowledge delivery practices in which vaccine administration was conducted and their varied outcomes for patients and on each other.

Next, we reverted to the literature to help refine and structure our interpretations. We found some of the existing literature on vaccination to be particularly useful in explaining some of our observations about the vaccine administration. However, the literature offered fewer insights into the activities and technologies producing the knowledge delivery practice in online communities. Also, the literature was almost not helpful in making sense of the influence of apparatuses on each other. This led us to observe the

critical role of materiality in delivering knowledge, especially in online communities. To make sense of the material production of knowledge delivery in practice, we found Barad's notions of material-discursive practices to be particularly valuable [170]. Then, we compared offline and online knowledge delivery practices in terms of Barad's conceptual framing and our emerging theoretical categories, iterating and interrelating these to develop key contrasts. This process led us to articulate crucial differences in the two apparatuses of knowledge delivery which further helped us to explain their different implications for patients and how they influence each other. In the following sections, we explore these differences

Findings

In discussing our findings, we first examine the offline vaccine knowledge delivery, a case of the institutionalized processes and criteria that have traditionally informed healthcare professionals in offline interactions with patients, and then turn to the online communities, the dominant example of the emerging processes and criteria that are becoming evident in online vaccine knowledge delivery.

Materialization and Performativity in Vaccine Administration

In comparing offline practices of knowledge delivery with those emerging on online communities, a number of significant discursive materializations come to light. In offline knowledge delivery practices the main source of knowledge delivery to patients was face-to-face interactions and/or written information during a physician, pharmacist, or health worker visit. This practice has been reconfigured with the emergence of online communities, particularly the ones on Facebook, where knowledge delivery is now materialized online and intended to engage the online crowd. The offline material-

discursive practices delivering healthcare knowledge face-to-face or on paper are significantly different from those knowledge delivery practices in online communities. Comparing these not only draws attention to the making of consequential discursive materializations associated with online communities, but also helps us to identify critical performative outcomes that they have on each other.

In offline environment, face-to-face interventions are used by healthcare professionals to educate patients, parents or guardians. Knowledge delivery and education may be materialized in various ways. These may include oral presentations, one on one or group classes or seminars, information sessions, or home outreach visits. Face-to-face communication may be undertaken on its own or combined with other interventions including telephone contact, handwritten or printed text, and multimedia material (e.g. power point presentation). The interactive nature of face-to-face knowledge delivery means that it is a straightforward way to share information, preferences, and decisions between providers and consumers. Being in close proximity to one another with the opportunity for eye contact, and the ability to observe non-verbal reactions contribute to the educator's ability to respond to fears and questions of a personal nature; correct misinformation and myths; persuade parents and bring about behavior change; provide support; and respond to rumors and anti-vaccination messages. Face-to-face communication can be delivered by a range of individuals including primary care physicians, nurses, lay health workers and community volunteers. In terms of timing, knowledge delivery to patients take place during their visit with a healthcare professional and before they are affected by vaccine preventable diseases (e.g. during an epidemic or outbreak). In the USA, the Centers for Disease Control and Prevention (CDC) is

recognized as the USA's premiere health promotion, prevention, and preparedness agencies. The CDC provides several immunization knowledge delivery materials, such as flyers intended to complement personal education and advice from healthcare professionals to patients. The CDC requires healthcare professionals to print and to provide Vaccine Information Statements (VIS) to patients when vaccinations are given:

“A vaccine, like any medicine, is capable of causing serious problems, such as severe allergic reactions. The risk of the MMR vaccine causing serious harm, or death, is extremely small. Getting the MMR vaccine is much safer than getting measles, mumps or rubella. Most people who get the MMR vaccine do not have any serious problems with it.” The CDC website: Information for Parents.

Knowledge Delivery Practices in Offline Practices

Since the first vaccine development in the 1790s, vaccination provoked fear and suspicion in people. Anti-vaccine movements were organized in the late nineteenth and early twentieth centuries in Europe and America. Anti-vaccine propaganda was materialized in posters, newspapers, word of mouth, and later on television [39]. As a result, many parents refused to vaccinate their children. Anti-vaccine people believe that health depends on preserving the body's integrity and vaccines contain harmful material [169]. For example, they believe that the administration of the MMR vaccine caused the occurrence of autism. Nonetheless, they mainly rely on anecdotes and fail to support their claims by scientific research.

Anti-vaccine people tend toward complete mistrust of government and manufacturers, conspiratorial thinking, denialism, low cognitive complexity in thinking patterns, reasoning flaws, and a habit of substituting emotional anecdotes for data [41]. Their

efforts have had disruptive and costly effects, including damage to individual and community well-being from outbreaks of previously controlled diseases, withdrawal of vaccine manufacturers from the market, compromising of national security

Specific protocols and guidelines have been created to protect people from anti-vaccine misinformation. Common ground might be difficult to achieve during the discourse between healthcare professionals and patients or parents due to controversies about vaccine safety. To counter anti-vaccine claims, the CDC offers healthcare professionals different communication strategies for successful vaccine discourse with parents and caregivers:

“If parents raise other possible hypotheses linking vaccines to autism, four items are key: (1) patient and empathetic reassurance that you understand that their infant’s health is their top priority, and it also is your top priority, so putting children at risk of vaccine-preventable diseases without scientific evidence of a link between vaccines and autism is a risk you are not willing to take; (2) your knowledge that the onset of regressive autism ⁷symptoms often coincides with the timing of vaccines but is not caused by vaccines; (3) your personal and professional opinion that vaccines are very safe; and (4) your reminder that vaccine-preventable diseases, which may cause serious complications and even death, remain a threat.”

The CDC' website: Talking with Parents about Vaccines for Infants, Strategies for Health Care Professionals

⁷ Regressive autism occurs when a child appears to develop typically but then starts to lose speech and social skills, typically between the ages of 15 and 30 months, and is subsequently diagnosed with autism [201].

Knowledge Delivery Practices in Online Communities

Online communities are configured to allow interactive discourse among many users simultaneously. Moreover, communication networks have shifted the configuration and speed of communication substantially, allowing information about vaccines and immunization to be gathered, analyzed, and used very differently compared with offline knowledge delivery practices. The amount of information in online communities has increased greatly, including scientifically valid data and evidence-based recommendations alongside poor quality data, personal opinions, and misinformation. In online communities, there is an equal opportunity to all viewpoints including pro and anti-vaccine views. Allowing outlier views and small extremist opinions the same space as views validated through a rigorous process of peer review by the scientific community exacerbates the challenges to public confidence in vaccines. There are three different actors in online communities: the decision maker (referred to as the user) as the receiver of information, health-communicators who disseminate evidence-based facts about vaccination as well as messages providing support for recommended vaccinations (e.g. the CDC) and anti-vaccination activists who disseminate messages, facts and beliefs that oppose some or all recommended vaccinations.

Online communities are configured to include comments in a relatively unconstrained text area, which facilitates the posting of detailed compositions. The website is multi-media which means that users can provide compelling illustrations of the points made. Both pro and anti-vaccine groups use online communities to materialize knowledge delivery to public in various ways including emotional content as a post or comment, sharing audio/video/image. Unlike offline environment, healthcare professionals and

organizations participate far less in online communities discourse and content sharing. Hence, anti-vaccine pages are more salient in online communities. Perhaps the most significant difference between the material enactment of delivering knowledge regarding vaccination in offline and online communities is the relationship that is implied and the degree of diffusion afforded to different constituencies. In addition to original concerns about the ease with which information is published and accessed online, these more recent commentaries have highlighted how the growingly participative nature of the online communities exacerbates transmission of rumors via diffusion processes based on personal trust and comparable to word-to-mouth.

Critical information found on online communities tends to induce more skeptical view toward vaccination safety. In addition, online community search engines have a critical role in making these contents easily accessible to the general public. Those communities that are against vaccination appear among the first lines of results when people enter vaccine-related keywords. Indeed, many users can come across vaccine critical information without looking for it, through the advertisement, suggestions, or tagging systems. The increasingly interactive and social configuration of online communities makes individuals more exposed to anti-vaccine content. For example, the DT is currently one of the most visible and active spaces for hosting online communications on vaccine safety issues aiming to inform people about the risks of vaccines and to stop mandated vaccinations. In contrast to the RA page on Facebook and the CDC website, these pages are not focused on providing vaccine administration guidelines or supporting the government's public immunization program. Instead, they mostly rely on peer contributions and materials on vaccine safety, or lack thereof. Several individual posts

include not only emotional anecdotes, but also assertions that their arguments are supported by scientific evidence:

“What makes Big Pharma any less guilty than those Nazis put to death by the Nuremberg trials? A published report acknowledged that MMR-Autism figures are completely bogus to scare the public and sell more vaccines.” DT

“Vaccine choice is a fundamental human right.” No truer words. 54% of children are suffering a chronic illness or are disabled, yet we push forced vaccination like its water.” DT

Our findings show that knowledge delivery in online communities is enabled through widely accessible, Internet based platforms supporting the proliferation of detailed personalized vaccine related pages. These pages are narrated with candid photographs by patients. The production of this qualitative information co-exists with “emoji”, “like” reactions buttons, and replies to a post or comment. Based on our analysis, these comments are usually left open ended, unfiltered by approved medical guidelines or explicit criteria, and variably reflect patients’ own interpretations and experiences on vaccination. These comments are then filtered through the online platform (here Facebook) algorithm to generate top comments that most patients have demonstrated interest in them by reacting or leaving a reply to them. These top comments are shown before other comments. Rather than conveying the medical community instructions that are based on scientific peer reviewed research, these comments expressed the anonymous and unregulated opinions of many patients. Facebook is careful not to reveal the details about the algorithm, but it is evident that the data used to calculate popular and top comments have changed over time. We argue that such platform and algorithms can make

it easier to share personal experiences and findings with a greater audience. Misinformation can also be easily disseminated in these algorithms and platforms as people do not often research the validity of the claims or the reference that is mentioned in a comment to support their claims against vaccines. Hence, compared to offline practices, anti-vaccine claims look less superstitious and more legitimate, scientific, and believable by patients in online communities.

Moreover, our data analysis shows that anti-vaccine supporters have used online communities to increase their presence, publicize, and dramatize cases of adverse vaccine reactions to the media. A tendency to promote personal and emotional content regarding risks of vaccination contribute to public fears and concerns regarding vaccines. Anti-vaccine supporters have been successful in finding active leaders for their online communities. According to our data, pro-vaccine communities use strategies that are mostly used by anti-vaccine supporters, such as sharing personal experiences, emotional content, and accusing the other group's credibility. For example, pro-vaccine communities shared an interview on the life of a person with polio who is extremely suffering and advocating for polio vaccination. An interesting observation is that both pro and anti-vaccine posts claim to have scientific support for their arguments:

“How much do I love my kids? I love my kids so much that I did not listen to the pediatrician. I love them so much that I have done real research versus reading blogs. I love them so much I did not vaccinated them and they are 100% healthy.”
DT.

“It isn't skepticism when evidence is straight up denied. It's science denialism. Period. (FYI I was a former anti-vaccine - but no longer). If there is a medical

reason for not vaccinating, then fine - that is between you and your doctor. But medical exemptions are not the issue. People refusing to vaccinate because they don't understand science and logic is the issue.” RA.

What is interesting and special about online communities and online knowledge delivery practices is that they enable people to easily access a very large amount of information on almost everything. Information overload creates confusion and controversy as people often have difficulty scrutinizing all the available information and properly distinguishing information from misinformation:

“Looks like a case of “if you can't prove something, overwhelm everyone with too much data”. There is no possible way that I could ever search through all that vaccine information, and I'd bet a pretty large sum of you haven't (and won't) either.” RA.

“Unfortunately these first world anti-vaccine people spread their anti-science and fear throughout vulnerable populations. We had a measles outbreak a few years ago in a refugee community in the US cause they were convinced that vaccines caused autism, by these people.” RA

Some of the differences in offline and online community-based knowledge delivery practices and their outcomes may be attributed to different characteristics of the knowledge delivery materials, technologies, and the people who deliver them. However, we suggest that there is more to be learned by shifting focus from educational materials and actors to practices of knowledge delivery. Understanding knowledge delivery as an apparatus produced through material-discursive practices helps us focus on the particular

agential cuts that make a difference to what is produced. That is, the specific observations and measurements of the knowledge delivery apparatus define and include some things in certain ways, precluding and excluding others and making certain properties and boundaries of the phenomenon being evaluated determinate-in-practice. In this way, knowledge delivery apparatuses are performatively entangled with the phenomena they assess. Studying material-discursive practices leads us to examine knowledge delivery practices not as a series of instructions given by healthcare professionals to patients, but as materially constructed within people, things, actions, texts, spaces and times. Knowledge that is produced by formally trained healthcare professionals using written instructions and guidelines, in their offices during patient's appointment, is significantly different from emotional and personal experiences that are publicly posted in online communities by anonymous users.

As we discussed earlier, in material-discursive practices certain properties of a phenomenon will become determinate, whereas others will be specifically excluded [170]. Hence, instead of viewing the findings as a mirror or lens through which we can see reality, findings are read through the apparatus [197]. That is why in online knowledge delivery practices by CDC, the anti-vaccine views are mostly excluded and only a few number of healthcare professionals are willing to take the discussion to online communities and discuss their pro-vaccine views. On the other hand, in online anti-vaccine communities, anti-vaccine views are expressed more often than pro-vaccine views. Hence, both online websites and online community apparatuses are boundary-making practices that focus agencies of observation on one thing instead of another. To study knowledge delivery practices as dematerialized is to ignore the large network of

connected people, information, opinions, things, and experiences. It is a critical point to consider as the apparatuses give order to the online crowd and are consequential for the public health.

The Influence of Apparatuses on Each Other

Based on our literature analysis, we created a timeline to show major events related to vaccine administration and the influence of pro and anti-vaccine views on each other since the invention of the first vaccine in 1796. Table 12, provides a timeline of vaccine administration, anti-vaccine movement, and how they influenced each other [39–43].

Table 12: Vaccine Timeline

Year	Event
1796	The first smallpox vaccine was developed by Edward Jenner in Berkeley (Gloucestershire), England.
1809	Immunizations were introduced in the USA in Massachusetts, to prevent and control smallpox outbreaks.
1840-1870	Under the Vaccination Acts of 1840, 1853, 1867, and 1871, the Poor Law Guardians in England were responsible for ensuring that all infants born within their districts were vaccinated against smallpox.
1876	Some guardians refused to enforce legislation regarding vaccine administration. Some protests happened. A fine of up to 20 shillings could be imposed on parents who refused to allow lymph to be taken from their children for use in public vaccination.

1905	The U.S. Supreme Court endorsed the rights of states to pass and enforce compulsory vaccination laws.
1940s-1970s	Anti-vaccine thinking receded in importance. There was significant decreases in disease outbreaks, illnesses, and deaths.
1970s	With fewer highly visible outbreaks of infectious disease and the media permitting widespread dissemination of poor science and anecdotal claims of harm from vaccines, anti-vaccine thinking began flourishing once again
1982	A television program on diphtheria–pertussis–tetanus (DPT) vaccination led to a national debate on the use of the vaccine. There was public protests. Countries that dropped routine pertussis vaccination suffered 10 to 100 times the pertussis incidence. Vaccine manufacturers faced an onslaught of lawsuits, which led the majority of them to cease vaccine production. These losses prompted the development of new programs, such as the Vaccine Injury Compensation Program (VICP), in an attempt to keep manufacturers in the U.S. market.
1990s	Pro and anti-vaccine movement materialized on the Internet
1991	A measles outbreak in Philadelphia that spread to more than 1,500 children and killed nine, began in private schools run by two fundamentalist churches whose 350 students had never been immunized.
1998	An article was published in by the Lancet linking MMR vaccine to autism. It was retracted in 2010. This claim led to decreased use of MMR vaccine

2009	Court denied the claims of more than 4000 parents of children with autism who claimed their children were harmed by vaccines.
2010 to present	Pro and anti-vaccine materialization online communities and power of narratives. People in those communities ranges from vaccine believers to the ones who are simply ignorant about science to those who use deliberate mistruths, intimidation, falsified data, and threats of violence in efforts to prevent the use of vaccines.
2015	The worst multi-state measles outbreak in 50 years happened and was linked to an amusement park in California.

Our findings show that in offline knowledge delivery practices, physicians are often seen as experts and their advice is trusted and followed by patients. In addition, patients here are mainly considered as passive recipients of knowledge, with limited authority to disagree with their physicians. In contrast, publicly sharing vaccine administration viewpoints on Facebook have performative outcomes that not only can influence offline knowledge delivery practices, but also their outcomes. For example, in recent years, the increasing use of online communities have fueled anti-vaccine movement, as online communities enable people to easily find others with the same views and to shape a community. Such community interactions can have performative outcomes on offline knowledge delivery practices in through collective actions and oppositions to policies that promote vaccination, which in turn triggers actions and reaction from the government, CDC, and RA.

Based on our analysis, most people benefit from the vaccination, but never or rarely are aware of its significantly positive role due to the gradual cessation of an epidemic. A minority are actually harmed. For this reason, the voices in online communities are unbalanced. In many cases, the minority may become the only ones who voice their opinions, thus causing a sense that the vaccine leads to more harm than good. Moreover, we found that knowledge delivery practices by healthcare professionals and CDC is consequential for anti-vaccine movement. Mandatory federal programs with punitive consequences for failure to comply, as opposed to ‘promotive’ immunization programs, may increase vaccine non-acceptance. Evidence for this is simply the large number of ‘anti-vaccine’ groups who frequently cite this issue. Additionally, federal attempts to institute childhood immunization registries in each county and each state add to concerns about the role of government in individual health matters, particularly the right of the government to ‘coerce individuals to have themselves or their children vaccinated. According to our results, the imminent expansion of vaccination schedules with more vaccines and vaccine combinations will stress parents’ perception that, in vaccination practice, ‘experts’ are making fundamental decisions about their children’s health, without consultation or providing the option to exempt.

On the one hand, while community shaping is one outcome of people interacting in online communities, losing trust in physicians and in health policy makers might be a more serious consequence. Indeed, many people now refuse to vaccinate their children as they lose trust in CDC and in public health officials. Our data shows that they accuse CDC and public health officials of not presenting the truth about vaccination risks in order to make more money:

“The fact that no action has been taken to get Dr. Thompson to testify makes me doubt that neither Congress nor CDC have any interest in holding people accountable or finding out the truth. Here's a great opportunity to increase much-needed trust in vaccines and the government agencies in charge of them but instead they appear to hope that this story gets buried and people will forget about it.” A post on Facebook page: Californians for Vaccine Choice.

“These bills are about money. Big Pharma can charge whatever they want for these vaccines. It's certainly not really about children or public safety.” A post on Facebook page: Californians for Vaccine Choice.

Based on our analysis, CDC and its powerful collaborators, including the Senate Judiciary Committee, are trying to control the public health and enforce vaccination by passing bills such as SB 277 (passed on June 2015 in California State Senate) that would eliminate the exemption from immunization based upon personal beliefs, and require schools to not to admit children, unless they show proof of immunization against some communicable diseases. Moreover, CDC provides several educational materials that aim at demonstrating vaccine safety to the public.

“One vaccine ingredient that has been studied specifically is thimerosal, a mercury-based preservative used to prevent contamination of multi-dose vials of vaccines. Research shows that thimerosal does not cause Autism Spectrum Disorder (ASD). In fact, a 2004 scientific review by the IOM concluded that "the evidence favors rejection of a causal relationship between thimerosal-containing vaccines and autism." Since 2003, there have been nine CDC-funded or conducted studies that have found no link between thimerosal-containing vaccines and ASD, as well as no

link between the measles, mumps, and rubella (MMR) vaccine and ASD in children.” The CDC website: Vaccines Do Not Cause Autism.

Hence, at a given time and place, the online community-based knowledge delivery apparatus, led to enactments in the offline knowledge delivery apparatus. In particular, anti-vaccine movement in online communities triggered government response and 1) passing bill SB 277 in June 2015 at California State Senate and 2) publishing additional educational materials supporting vaccine safety to the public. These two enactments changed the materializations in offline knowledge delivery practice in terms of activities, instruments, measures, texts, and media.

In addition to the CDC, the RA also tries to refute anti-vaccine claims using online communities. Through online community posts, memes, and emotional arousing stories of other patients, the RA tries to influence anti-vaccine people.

“Remember, anti-vaccine doctors are performance artists. They give speeches and make YouTube videos patting themselves on the back as they drone on and on about what they *would* do if they treated sick people. You'll never find one in a hospital actually doing that, however.” RA.

However, our data show that government officials rarely use online communities as a legitimate apparatus to oppose anti-vaccine claims. They try to communicate with people through other ways including their official websites such as the CDC, mass media such as TV and newspapers, and through instructions given by healthcare professionals, nurses, and pharmacists in the form of offline and face-to-face interactions, booklets, and written physicians' instructions.

Therefore, as we have seen in this study, although both pro and anti-vaccine groups have access to online communities and offline interactions, anti-vaccine groups tend to use online communities and pro-vaccine groups tend to use offline interaction as their knowledge delivery apparatuses. As we showed in this study, different apparatuses have different performative outcomes and these outcomes can create tension between the apparatuses.

Conclusion and Discussion

To date, online communities have been studied as a platform for knowledge collaboration and crowd-sourced knowledge. However, with the proliferation of knowledge and the spread of different viewpoints in online communities, come doubts. When scientific knowledge from moon landing to vaccine safety faces organized and often furious opposition empowered by non-scientific interpretations of research or misinterpretations of correlation as causality, doubters declare war on the consensus of scientific knowledge (e.g. moon landing conspiracy theories and vaccine controversies). People often encounter contrasting sources of knowledge, which makes distinguishing knowledge from misinformation a complicated and sometimes unnerving task. As a result, people face uncertainties, risks, and fears they cannot easily analyze.

Drawing upon material-discursive practices, explained how different apparatuses of knowledge delivery have different performativity and outcomes. Using an inductive approach, we studied how offline and online community-based knowledge delivery practices have different configurations. Moreover, we uncovered how these practices influence and create tensions for each other. Until now, the extant literature has shown how knowledge delivery practices are actively produced [7,39,167,171]. We contribute to

the extant literature by showing that offline and online community-based knowledge delivery practices are not only configured differently, but also generate significantly different knowledge. Moreover, as discussed earlier [175], the nature of knowledge depends upon the practice and the site of it. If the knowledge is obtained from online communities, there is necessarily a shifting in the knowing because online communities and physician's office where they meet face-to-face are two different sites.

From an IS perspective, we conducted our analysis to elaborate on how the particular technological configurations deployed in offline and online community-based knowledge delivery practices might influence the vaccine controversies that are played out. For instance, we explored who is able to present knowledge, what is the format of the knowledge, and how the knowledge is delivered. Through our analysis, we also considered how the nature of the vaccine controversies, which predate the Internet, may have been influenced by the particular forms of the IT involved. We argue for multiple relational enactments and hence, multiple performativities in the world. Shifting the focus from one material-discursive practice to multiple practices enables us to look at the phenomena at a broader view and study how performative outcomes of one practice can reconfigure local causal structures, boundaries, and properties of another practice.

Good communication with patients is the cornerstone of effective knowledge delivery by healthcare professionals [181]. From obtaining patient's medical history to conveying a treatment plan, healthcare professional relationship with patient is built on effective communication and education. In these encounters, both verbal and nonverbal forms of communication constitute this essential feature of medical practice [202]. Previous work has proposed different methods for informing patients such as paper-based healthcare

packages, computer and internet-based data, and mass media [167]. Different verbal and non-verbal materials are used to produce knowledge and educate patients such as verbal explanations, hand-written materials, printed materials, multimedia (CDs and DVDs), and more recently, the Internet [170]. As nearly all healthcare professionals use verbal explanations to deliver knowledge to their patients, there are several guidelines for this practice such as assessing of what patient already knows, providing information in a slow and deliberate fashion to allow the time needed for patients to comprehend the new information, providing short, clear, and simple explanations, telling the truth, and using appropriate body language while talking to patients [202].

Creating knowledge delivery materials by healthcare professionals follows established guidelines and assessment tools to evaluate the readability and comprehensibility of the materials [181]. In knowledge production for patients, quality is more important than quantity since understandable and actionable information has become recognized as an important aim of patient education materials. Furthermore, patient education materials are actionable when patients with diverse backgrounds and varying levels of health literacy can identify what they can do based on the information presented [202]. Established development approaches to produce patient education materials include different steps such as reviewing existing materials to identify relevant constructs and determining the understandability of the materials. Overall, knowledge development approaches enable healthcare professionals to effectively focus on the functionality of the educational materials for patients [181].

In addition to the above theoretical implications, this study has a number of practical implications as well. Concerns about vaccine safety have hampered efforts at increasing

immunization rates among people. The controversy and alarm caused by knowledge delivery practices in online communities is consequential and has a detrimental effect on vaccine coverage rates in the society. As we have demonstrated within this paper, there is an ongoing tension between knowledge delivery practice in online communities and by healthcare professionals (here CDC). To protect people against infectious diseases, healthcare professionals can engage the public and demonstrate the safety and benefits of vaccines in a manner that protects individual rights of autonomy and freedom of choice. Efforts at developing promotive, rather than prescriptive immunization programs are likely to achieve better long-term results in a free society where trust in government and public health recommendations must be maintained.

Chapter Four: Essay #3: Online Reviews and Their Impact on Risk-Sensitive Decisions

Introduction

Online communities are known to have transformative effects on social processes [2], user decisions [203], satisfaction [204], creativity [45], and performance [205]. A widely used feature that plays a pivotal role in the success of online communities is the ability to write and access online reviews [45,206,207]. Online reviews contain user perspectives about items (e.g. products, services, information) and their performance [208]. These reviews have become an important information source for people to mitigate uncertainties about items and decide whether such items can fulfill their needs [67].

As decision making is an important construct for understanding individual behavior [209], different studies have analyzed the impact of online reviews on decision making [47–49]. For example, it has been shown that online reviews can induce decision shifts [210] because they can provide persuasive arguments on information not available to individuals prior to their initial understanding. Nonetheless, there are two issues in the extant literature that require more attention. First, so far, literature on online reviews has mainly viewed user decisions as purchasing decisions from online retailers [47,49]. Such view can be limiting when considering decisions of different nature. In particular, online review literature has been mostly silent regarding risk-sensitive decision making. Decision risk is “the extent to which there is uncertainty about whether potentially significant and/or disappointing outcomes of decisions will be realized” [58]. Risk-sensitive decision making often has a different pattern than low risk decision making and people make riskier decisions when in peer groups than alone [51,52]. For example, in

risk-sensitive decision making, perceived risk impacts attitudes and perceived behavioral control of individuals [211]. Considering the increased popularity of online communities in risk-sensitive domains such as healthcare [212], it becomes important to examine how online reviews influence risk-sensitive decisions. In this study, we examine the said impact in the context of health-related online communities as health decisions often involve open exploration of new and uncertain options that directly impact people's health [59].

Second, prior findings in the online review literature have some pre-assumptions about user cognition that lead to apparent but unexplored contradiction. On one hand, it has been shown that early reviewers hold different cognitions than do later reviewers [60]. On the other hand, online reviews are perceived to be more helpful when they are in agreement with the previously established ratings by early reviewers [50]. As early reviews are biased, later ones that are perceived to be more helpful will also be biased. We argue that this issues can be resolved, if we alter the underlying assumption in these studies. In particular, prior studies subtly assume that people solely rely on online reviews to form their initial cognitions⁸, reduce uncertainties, and make decisions [50]. This assumption is problematic when the degree of decision risk is high: depending on the importance and risk of a choice at stake, people are likely to use multiple sources of information to shape their initial cognitions prior to accessing online reviews [213]. For instance, people lean heavily on the advice of healthcare professionals to form initial cognitions about their health and medication [62]. Therefore, drawing on the approach [63] for theoretical problematization, we relaxed this assumption and propose an

⁸ Cognition refers to “any knowledge, opinion, or belief about the environment, about oneself, or about one's behavior” [13], page 3.

alternative one: A person can shape an initial cognition from information sources other than online reviews. Such problematization or challenging underlying assumptions in prior theories has been regarded as “a central ingredient in the development of more interesting and influential theories within management studies” [63].

Currently, the online review literature is sparse on the role of initial cognitions in risk-sensitive decision making. To address this gap, we draw on cognitive dissonance theory [13] for three reasons. First, it enables us to account for initial cognitions in decision making. Cognitive dissonance occurs when a person holds two or more conflicting cognitions about an issue. In other words, when an initial cognition differs from a later one, cognitive dissonance occurs. Second, this theory is useful in explaining how cognitive dissonance can be reduced. Cognitive dissonance is an uncomfortable psychological state that people try to reduce [13]. To reduce cognitive dissonance, we argue that two widely used online review features are important: social verification (e.g. social proof) of the review and self-verification of the reviewer (e.g. reviewers with rich profile data) [68,71,214]. Drawing on cognitive dissonance theory [13], we further argue that obtaining new information that confirms the initial cognition is another mechanism for reducing cognitive dissonance, in online communities. Third, cognitive dissonance theory enables us to show the impact of cognitive dissonance on individuals’ decision making. Cognitive dissonance is unavoidable in online communities, and if cognitive dissonance occurs as a result of accessing online reviews, people may change their decisions.

There are three research questions that this study aims to address. First, our overarching research question in this study is: “What is the impact of online reviews on risk-sensitive decision making?”. Our second and third research question are more specific: “What is

the impact of online reviews on user cognition, when they have not obtained their initial cognitions from online reviews?” and “How online review users can reduce their cognitive dissonance?”

Online reviews play a key role in decision making under the conditions of uncertainty and environmental pressures [48]. This work contributes to the literature by highlighting the role of online reviews in risk-sensitive decisions and in reducing cognitive dissonance for individuals. We start with presenting the theoretical background on cognitive dissonance theory, how it has been applied in IS research, and how cognitive dissonance can be reduced. Next, we elaborate on our research model, context of the study, and hypotheses. Following the presentation of the methodological considerations including the sampling, data collection and data analysis, we analyze our survey data focusing on the role of online reviews in risk-sensitive decision making. After presenting the findings, we revisit extant literature on online reviews and discuss the implications of this work for the IS literature.

Theoretical Underpinnings

Using cognitive dissonance theory [13], we aim to show how users can experience cognitive dissonance after receiving online reviews, and in what ways online platform features are consequential in users’ decision making. Cognitive dissonance theory explains the psychological conflict from holding two or more incompatible cognitive elements⁹ simultaneously. Two cognitive elements are dissonant with each other, if they do not fit together, that is, if they are inconsistent. In other words, considering only two

⁹ “These elements refer to what has been called cognition, that is, the things a person knows about himself, about his behavior, and about his surroundings. These elements, then, are “knowledges,” if I may coin the plural form of the word. Some of these elements represent knowledge about oneself: what one does, what one feels. What one wants or desires, what one is, and the like. Other elements of knowledge concern the world in which one lives: what is where, what leads to what; what things are satisfying or painful or inconsequential or important, etc.” [13], page 9.

particular cognitive elements, if one does not follow from the other, users experience cognitive dissonance.

According to this theory, individuals are purposeful decision makers who strive for balance in their cognitive elements. Dissonance is psychologically uncomfortable enough to motivate people to achieve consonance [13]. Moreover, the pressures to reduce inconsistency follow from the fact that consistent structures “are simpler to maintain than distinctions, discrepancies and contradictions” [13]. For example, when people seek new information, these information search processes are often biased in favor of the information seeker's previously held beliefs, expectations, or desired conclusions. Such biased information search processes lead to the maintenance of the information seeker's position (decrease dissonance), even if this position is not justified on the basis of all available information [65].

All dissonant relations are not of equal magnitude [13]. The magnitude of dissonance between two cognitive elements is a function of the importance of those elements. The more the elements are valued by a person, the greater the magnitude of the dissonant relationship between them. For example, when a person wants to purchase a trivial item (e.g. a paper cup) and s/he knows that her/his present knowledge of different brands of the cup is inadequate, the magnitude of the dissonance is small because the elements that are dissonant with each other (purchasing a paper cup and no knowledge of different brands) are often unimportant to the person. However, much greater dissonance is involved if a person aims to purchase a house and knows that her/his present knowledge of buying a house is inadequate. In this case, the elements that are dissonant with each other are often very important to the person and the magnitude of the dissonance is great.

Hence, the higher the magnitude of dissonance, the greater the pressure is to reduce or eliminate cognitive dissonance [13].

There are three ways that dissonance can be reduced or eliminated: changing a behavioral cognitive element (e.g. changing opinion, behavior, etc.), changing an environmental cognitive element (e.g. changing the situation, product, etc.), and adding a new cognitive element (e.g. adding a new opinion that is consistent with the old one) [13]. If a behavioral cognitive element is to be changed without changing the corresponding environmental cognitive element (reality), some means of ignoring or counteracting the reality should be used [13]. For example, a person might be able to change her/his 'negative opinion' about a product to a positive opinion even though the product remains unchanged. Usually, for this to occur, the person would have to be able to find others who would agree with and support her/his 'new positive opinion' about the product. Moreover, dissonance can be reduced by adding a new cognitive element that is consistent with a prior belief [13]. For example, in an attempt to reduce cognitive dissonance, a person searches for new information that confirms her/his prior cognition. In online communities, individuals may feel the pressure to reduce or eliminate their cognitive dissonance as a result of contradictory information (i.e. receiving contradictory reviews). Furthermore, people may join online communities already having cognitive dissonance and seek ways to reduce their dissonance using the online reviews.

In IS literature, the expectation-confirmation model [65] draws on cognitive dissonance theory and has been previously used to explain user pre-adoption expectation and post-adoption behavior such as IT use continuance [65,216], customer satisfaction, and loyalty [217]. According to the expectation-confirmation model, first, users form (ex-ante)

expectations of a technology, product, or service prior to adoption. Next, IT use results in an (ex-post) perceived performance that is influenced by these expectations. The perceived performance may confirm or disconfirm pre-use expectations. Therefore, if confirmation occurs, users' satisfaction [218] or IT continuance intentions [65] will increase or decrease from its baseline level. For example, users expect a new IT system to be easy to use, however, after working with the system, their expectations is not confirmed; hence, they have low intentions to continue to use the system. In the online review context, the expectation-confirmation model is used to explain why some users find positive reviews more helpful, while others find negative reviews more helpful [50]. For example, a user compares the content of a review with her/his initial beliefs and if the review is consistent with her/his initial beliefs, s/he finds the review more helpful [50].

While the expectation-confirmation model examines users' initial beliefs, it does not include mechanisms for reducing cognitive dissonance. In this study, we add important factors such as *social verification (i.e. social proof) of a review*, *identity information of the reviewers*, and *new information* to explain how online review features can be used to reduce cognitive dissonance. For example, this model is unable to explain what happens if a review disconfirms an individual's expectation, but at the same time many people rate this inconsistent review as a helpful one (i.e. the review has social verification). Moreover, the expectation-confirmation model does not account for the reviewer's identity information. For instance, a review disconfirms an individual's expectation, but at the same time evidence shows the review is provided by someone very similar to the individual (i.e. the review has self-verification). In the presence of such additional information, we do not know, whether the individual will still rely on the comparison

between her/his initial beliefs and the content of the review, or s/he will take into account the social and self-verification of the review as well. In light of these considerations, we focus on two mechanisms for reducing cognitive dissonance in online communities: changing a behavioral cognitive element and adding a new cognitive element (i.e. adding new information that confirms the initial cognition) [13].

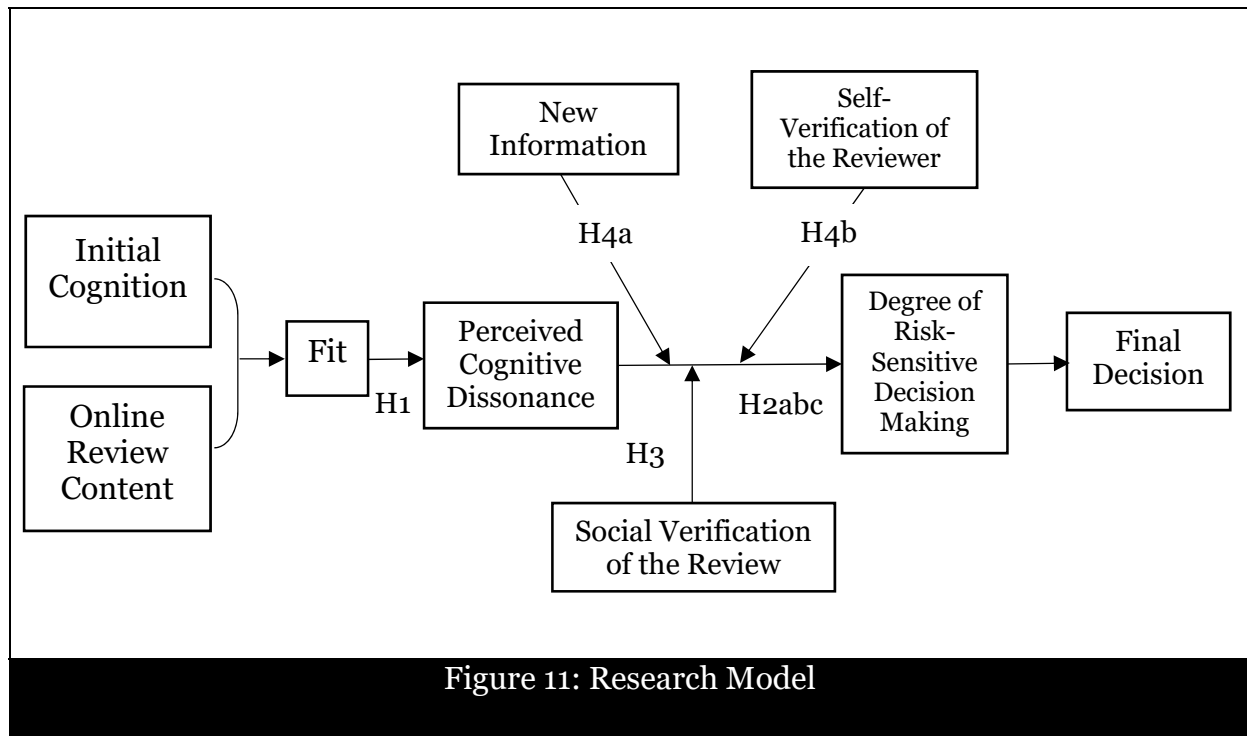
Regarding the first mechanism, as stated previously, for a person to change her/his behavior or opinion without changing the corresponding reality, some means of ignoring or counteracting the reality should be used [13]. As such, the person would have to be able to find others who would support her/his new opinion or behavior. In online communities, such support can be found in the form of social-verification of a review [66,219]. For example, if a patient wants to change her/his opinion in favor of a treatment, realizing that several patients have found the treatment effective, can help the patient to change her/his opinion about the treatment.

Regarding the second mechanism to reduce cognitive dissonance, a person can search for new information in online reviews that is consonant with her/his prior belief. The net effect of this would be to increase the proportion of relevant information and hence to decrease the total dissonance that exists [13]. For example, a person knows that not having regular exercise is unhealthy, but is looking for a way to justify her/his lack of exercise. According to cognitive dissonance theory, finding out that the danger from no exercise is negligible compared to the danger s/he faces if s/he smokes, her/his dissonance would be somewhat reduced. Although there is also a third mechanism for reducing cognitive dissonance it is not the focus of this study because this mechanism requires a change in an environmental cognitive element such as the product or the

situation. Considering the context of this study (i.e. patients' cognitive dissonance), it is not feasible for a patient to change the situation (here her/his medical situation) in order to decrease cognitive dissonance. However, our context makes it is possible to test the first two mechanisms: (1) when the patient adds a new cognition and (2) changes her/his belief about the medication.

Research Model

We use cognitive dissonance theory as a lens to study how receiving online reviews impacts users' risk-sensitive decisions. Cognitive dissonance may be unavoidable in online communities where different and conflicting information can be shared via online reviews. In such communities, users can access online reviews from a large number of individuals who are sharing informal information and a mixture of scientific/non-scientific evidence grounded in personal perspectives and experiences. Such mixture of information in online reviews can cause users to experience cognitive dissonance and change their decisions [220–222]. As such, scrutinizing the role of online reviews to understand how IT impacts decision making becomes significant. See Figure 11.



In the following paragraphs, we present the main constructs in our research model. We argue that lower levels of fit between online reviews and user's initial cognition leads to higher cognitive dissonance. Users who have higher cognitive dissonance are more likely to make riskier decisions after reading online reviews.

Two mechanisms help users to reduce their cognitive dissonance. The first mechanisms is adding new information confirming the initial cognition [13]. To reduce cognitive dissonance, the person actively searches for new information that would reduce the total dissonance and at the same time, s/he avoids new information that might increase the existing dissonance. However, it is quite possible that in the process of trying to reduce dissonance, it might even be increased. This will depend on what the person encounters while trying to reduce dissonance. Additionally, in online communities, profile information of the reviewer can help the user to have a better understanding of who the

reviewer is. This information can add a new cognitive element. If the added information is consistent with the initial cognition, the user can reduce her/his cognitive dissonance [13].

The second mechanism includes social verification of the review or “social proof”. Using this mechanism can help a user to reduce cognitive dissonance by showing that a lot of other users in the online community have rated the review as a helpful review or “liked” the review. In this mechanism, the user can change her/his behavioral cognitive element by finding similar others who agree with the a cognition [13].

User Decision Making

In his seminal work, Simon [223] argued that people are rational decision makers, but only within the constraints of their perception of a decision problem. Since then, a wealth of research has been done in that line of study [224–227]. From an IT perspective, decision support technologies are designed to provide decision makers with the additional capabilities to extend their bounds of rationality, or help them implement normative decision making strategies [228]. More specifically, it has been shown that, decision makers attempt to compensate for their limited abilities by constructing a simplified representation of the problem and behaving rationally within the constraints of this model [229,230]. In so doing, online reviews greatly help users to make a better decision more easily [67]. Prior work has suggested that among different elements to making a choice, cost and accuracy are the most prominent ones [231]. While decision makers try to maximize the accuracy (e.g. quality of the decision) and minimize the cost (e.g. the effort needed for decision making), people put more weight on effort reduction [228]. As the ability to explore information about alternatives helps users make better decisions

[232], online reviews can provide diagnostic value and minimize the cost across multiple stages of the decision process including the stages of need recognition, information search, evaluation of alternatives, decision, action, and post-decision [231]. If we consider online reviews as a system to support decision making, first, they can help users to decompose decisions into the subcomponents and evaluate the cost of different strategies. Second, they can identify the tools required to apply a specific strategy. Third, by automating storage, retrieval, and computational tasks, they can reduce the cognitive effort [228].

Risk-Sensitive Decision Making

The investigation of risk-sensitive decisions has a long tradition in psychological decision theory [51,220,233,234]. Risk is a characteristic of decisions and is defined as “the extent to which there is uncertainty about whether potentially significant and/or disappointing outcomes of decisions will be realized” [58]. Based on this definition, three key dimensions of risk-sensitive decision making can be identified: outcome uncertainty, outcome expectations, and outcome potential.

First, outcome uncertainty can be defined in terms of the variability of outcomes, lack of knowledge of the distribution of potential outcomes, and the uncontrollability of outcome attainment. Higher variance in the distribution of outcomes increases the uncertainty with which a given outcome can be predicted. Therefore, risk is high in situations where outcomes cannot be influenced by the decision maker. Second, outcome expectations is the degree to which decision making outcomes would be disappointing to the decision maker. Third, outcome potential can be defined as the magnitude of outcomes of the decision. The magnitude of the decision outcomes must be sufficient enough for decision

makers to consider the potential threat or opportunity of the situation [52]. Questions such as "How bad could it get?" or "How much could I win?" reflect this dimension of risk-sensitive decision making.

Decision risk has been widely tested in the gambling experiments by using choices among gambles or bets (simple lotteries) as decision tasks [235–237]. Several studies have shown that anticipated regret forces participants towards the safe option, showing risk-aversion. In other words, people often prefer a sure thing over a gamble with the same or even higher expected value [238]. Hence, regret-minimizing choices are preferred over risk-minimizing choices. Most experimental results in research on risk-sensitive decisions have been obtained with lotteries. However, choices between lotteries differ in many respects from natural risk-sensitive decision tasks [226]. The mode of information presentation in gambling experiments is very different from natural situations. In naturalistic tasks, probability is used less often than expected from classical decision theory, whereas the search for new alternatives, worst-case plans, and control considerations are more relevant [226].

Compared to ordinary online purchasing decisions, health decisions can be considered as risk-sensitive decisions because they often involve open exploration of new and unknown possibilities that directly impact people's health [59]. There are many things to consider when making a health decision including the cost, timing and regularity of medical treatment, as well as the potential impact on family, friends and working life [239]. Making health decisions can be overwhelming, time consuming, and emotionally challenging for patients. People need to understand the current situation, what they hope to achieve, and what options are available to them to bring about the desired result [240].

However, by exploring the issue thoroughly before making a decision, some of the anxiety and confusion may be reduced. Moreover, with the popularity of online communities, many patients use them to find similar others and gain additional information.

User Cognition

Cognition is a person's knowledge about her/himself, her/his behavior and surroundings [13]. "Some [cognitive] elements represent knowledge about oneself: what one does, what one feels. What one wants or desires, what one is, and the like. Other cognitive elements concern the world in which one lives: what is where, what leads to what; what things are satisfying or painful or inconsequential or important, etc." [13]. Therefore, in line with the definition of cognitive elements [13] and consistent with the extant literature on social cognitive theory [241] and cognitive processes [242], cognition can be considered as a construct composed of knowledge about oneself and knowledge about the environment [13,241]. We believe that users can form initial cognition from multiple online and offline sources (e.g. advice from experts and friends, average ratings in online communities). In this work, we focus on the impact of online reviews on users' initial cognitions and cognitive dissonance.

Cognitions about medication risk (i.e. belief about potential medication side effects) is central to most health-specific behavioral theories [243] including the health belief model [244] and protection motivation theory [245]. In line with the context of this study, we consider *cognition on medication risk* as a proxy to capture user's initial cognition. It can be defined as the person's belief or opinion of the degree of adverse medication effects on herself/himself. Therefore, this construct captures both knowledge about oneself (here,

personal health condition) and knowledge about the environment (here, knowledge about the treatment).

Patient as User

To make health decisions, patients can shape their cognition about medication risk from different sources. In this section, we elaborate on decision making stages including information exchange, deliberation, and decision making in three models of health decisions: paternalistic, shared, and informed decisions. Moreover, in shared and informed models of decision making, patients consult physicians and potential others to obtain more information about the treatment and make a decision. As such, patients have access to additional sources of cognition in these models.

As shown in extant literature, healthcare decision making can be understood as a continuum with two extremes the paternalistic model and the informed model.

Table 13, illustrates this continuum where shared decision model fits between the two extremes. There are three steps in decision making process: information exchange, deliberation about treatment, and deciding on which treatment to implement [246].

Information Exchange

Information exchange refers to the type and amount of information exchanged between physician and patient and whether information flow is one or two ways. Types of information that the physician might communicate to the patient include medical information about the treatment which most patients will not have [247]. On the other hand, information that the patient might reveal to the health care professionals include

patient's lifestyle, social context, and beliefs [246]. The goal of this exchange is to make explicit how each expects the decision making process to proceed.

Table 13: Decision Making Models

<i>Decision making stages</i>	<i>Models</i>		
	Paternalistic	Shared	Informed
<i>Information exchange</i>	<ul style="list-style-type: none"> • One-way flow from physician to patient. • Minimum, legally required medical information 	<ul style="list-style-type: none"> • Two-way flow from physician and patient. • All relevant medical and personal information for decision making 	<ul style="list-style-type: none"> • One-way flow from physician to patient. • All relevant medical information for decision making
<i>Deliberation</i>	Physician	Physician and patient (plus potential others)	Patient (plus potential others)
<i>Deciding about treatment</i>	Physicians	Physician and patient	Patient

In the paternalistic model, the exchange is one way and the direction is from physician to patient. At a minimum, the physician must provide the patient with legally required information on treatment options and obtain informed consent to the treatment recommended [248]. In general, this model assumes that the physician knows best and will make the best treatment decision for the patient.

In shared decision-making model, the information exchange is two way. Physician must inform the patient of all information that is relevant to making the decision such as information about available treatment options, and the benefits and risks associated with each option. Patient needs to provide information to the physician on his/her values,

preferences, lifestyle, beliefs. This model ensures that all relevant treatment options are considered and both the physician and the patient evaluate the options while considering the patient's requirements and preferences [247].

In the informed model, information exchange is one way, from physician to patient. The physician in this model is assumed to be the primary source of information to the patient on medical issues about the treatment options. The physician gives the patient all relevant information about the benefits and risks of alternative treatments, and the patient is responsible for deliberation and making a decision.

Deliberation

The deliberation stage of decision making is the process of expressing and discussing treatment preferences. In the paternalistic model, physician explains the benefits and risks of treatments while patient has a passive role. Physician dominance is justified by clinical judgment and experience. In this model, physician has the authority to decide what is best for the patient, even if the patient disagrees [249]. Physician may verbally communicate to the patient only the final treatment decision without any further explanation and patient's value consideration. The lack of patient involvement is the main reason why this model is undesirable for many individuals [168].

In the shared model, physician and patient engage in the decision making process by expressing treatment preferences and their values. In this interactional process both physician and patient have a legitimate investment in the final decision. The interactional process is consensual when both parties have the same treatment preferences. If they have different views, a process of negotiation occurs [247]. Physician legitimately gives a

treatment recommendation to the patient and considers patient's preferences for treatment options. Furthermore, patient may decide to share any or the entire decision making steps with persons other than or in addition to the physician such as their families and/or friends [250].

In the informed model, as noted earlier, patient proceeds through the deliberation alone. Physician's role is limited to providing medical information that will enable the patient to make an informed decision. In this model, physicians do not have an investment in the decision making process or the final decisions while patients have the rights to make independent and autonomous treatment decisions. The informed model meets patients' needs for autonomy in decision making, but it fails to meet the needs of physicians to participate in treatment decisions which is a key part of their clinical role [248].

Deciding about the Treatment

The final task in the decision making process is choosing a treatment option. In the paternalistic and informed models, the decision maker is physician and patient, respectively. However, in both cases the decision maker is not totally autonomous because each faces constraints in implementing the decision. The physician must have the patient's informed consent before proceeding and the patient needs the physician's agreement to implement her preferred treatment [247]. In the shared model, both parties, work towards reaching an agreement and both parties have an investment in the ultimate decision made [247].

Online Reviews

Online reviews play a vital role in online communities [207]. Online reviews are remote communications regarding a brand, a product, a service or a provider [47]. Online reviews are user-oriented. They often describe product/service attributes in terms of usage situations and measure product/service performance from a user's perspective [208]. Online reviews are influential in complex decision processes where the decision maker seeks suggestions to reduce the uncertainty and amount of information that must be processed to make a decision [47]. The role of reviews in online communities are important because people generally seek approval from others [251] and they are affected by other people's views [204]. In particular, compared to positive reviews, negative reviews are more influential on perceived reliability of users [47]. Moreover, the extent of information search in online reviews by users depends on their reasons for making a decision [48]. In case of risk-sensitive decisions, people actively search for more information to make better decisions [234].

Social Verification of the Review

One mechanism to reduce cognitive dissonance in online communities is social verification of the review. It refers to the perceived social proof of the review and is defined as "looking to the actions of others for clues as to what constitutes appropriate action" [68]. According to cognitive dissonance theory, to reduce cognitive dissonance, a behavioral cognitive element or an environmental element should be changed. "If a cognitive element that is responsive to reality is to be changed without changing the corresponding reality, some means of ignoring or counteracting the real situation must be used" [13], page 21. For example, a patient might be able to change her/his opinion

about a treatment even though the treatment and the medical situation remain unchanged. The patient can change her/his opinion if s/he finds others who would agree and support her/his new opinion. Such social support in social media is expressed through the likes and reactions that users express to online reviews.

New Information

To eliminate dissonance, some cognitive element must be changed. While this may not always be possible, a user can reduce the magnitude of dissonance by adding a new cognitive element or a belief [13]. For instance, if dissonance is present regarding smoking, a person might actively seek new information to reduce dissonance by reading any material that is critical of the research on the health hazards of smoking.

Self-Verification of the Reviewer

Self-verification of the reviewer refers to the depth and breadth of information that the reviewer makes available to other users in the online community about her/himself such as profile data, preferences, etc. [214,252,253]. As additional information about the reviewer can increase the chance of adding new cognitive elements for the users, it appears that higher self-verification of the reviewer can reduce cognitive dissonance for users. For instance, a user experiences cognitive dissonance when s/he finds out online reviews disconfirm her/his prior belief about a product. However, if the person finds out that those reviews are provided by people with similar preferences and conditions to the individual, this new information can reduce cognitive dissonance by influencing the user to believe her/his prior belief was not a valid one.

Perceived Cognition-Review Fit

Prior work has shown that individuals form their initial cognitions about a product/service based on the aggregated rating statistics available online such as the average product/service ratings and the dispersion of ratings [60,67]. However, in this work, we argue that people can shape their initial cognitions from offline sources as well. Initial cognition plays a vital role in their evaluation of online reviews because they can create confirmation bias for people [77]. That being the case, after reading online reviews, patients can compare their initial cognitions about the medication risk with their online reviews content. If there is a misfit between them, patients can experience cognitive dissonance [13]. For example, if patients' initial cognition is that a treatment has low risk, but online reviews indicate that the risk is high, there is a misfit between the two, which leads to cognitive dissonance for patients. However, online platform features such as social verification of the review and self-verification of the reviewer can provide additional cues to users and decrease their cognitive dissonance.

Context

As different and conflicting information can be shared in online communities, users may experience cognitive dissonance and decision shifts that are not always satisfactory for them [204]. That being the case, when the degree of uncertainty is high and the decision is a sensitive and risky one, poor decision making can have negative consequences for people. Healthcare is a well-suited context epitomizing the consequential role of online reviews and cognitive dissonance on risk-sensitive decisions. Such context can also show how crowd knowledge can undermine years of training and expertise of healthcare professionals, when people are influenced by online reviews to make risky decisions.

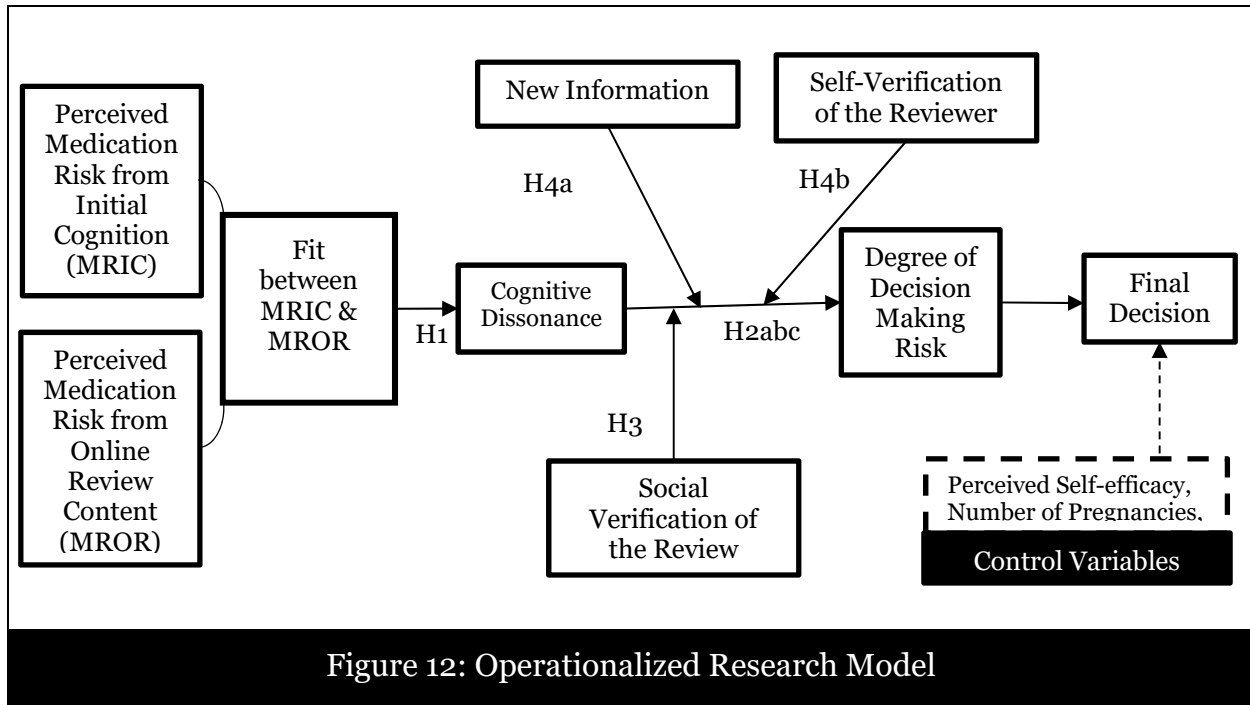
We study the impact of online reviews on pregnant and breastfeeding mothers who want to make a risk-sensitive decision on whether to use a medication or not. According to a recent study, the majority of women in Europe, North America, South America and Australia use at least one medication during pregnancy [255]. Perception of risk by pregnant and breastfeeding women will impact their decision to use a medication, especially when using over-the-counter (OTC) medications [256]. In case of prescribed drugs, a woman's perception of risk may affect her decision to adhere to her physician's prescription.

Not all the drugs have been approved as safe and effective to use during pregnancy and lactation [257]. As a result, several medicines given to a pregnant or breastfeeding women, from prescription antacids for acid reflux to biologic drugs to prevent epileptic seizures, are considered an off-label use. In 2016, US Congress created a task force through the National Institutes of Health to study why so few women can get reliable answers on medication use during pregnancy. Moreover, because the body changes in different ways during pregnancy, standard doses of medication might be too high, or too low for an expectant or breastfeeding mother, depending on how a specific medication is distributed and absorbed in the body. As a result, taking medications can be a risk-sensitive decision for pregnant and breastfeeding mothers.

Many people use online reviews to obtain information on medications [75]. With the rise of online communities that create customized disease-specific outcome and visualization tools to help people understand and share information about their conditions, people can provide and receive online reviews about different drugs more than ever [75]. Currently, there is a paucity of research on the role of online reviews in risk-sensitive decisions about

taking medication during pregnancy and breastfeeding. This work seeks to fill this gap by adopting cognitive dissonance theory as a lens to explain the impact of online reviews on decision making in risk-sensitive situations.

Moreover, based on cognitive dissonance theory [13], dissonant relations have different magnitudes for individuals. The magnitude of dissonance between two cognitive elements is a function of the importance of those elements. The more the elements are valued by a person, the greater the magnitude of the dissonant relationship between them. Therefore, magnitude of dissonance is controlled for in our model. Considering the context of our study, the magnitude of dissonance is implicitly controlled for as people put a lot of weight on their health conditions [258,259]. We believe that accessing online reviews about taking medication during pregnancy and lactation period can create a high magnitude of dissonance. See Figure 12.



To enhance informed choices, healthcare professionals provide the required information on medication risk to people [247]. In this study, we assume that a user can shape initial risk perception from information sources other than online reviews. The user, then reads online reviews to obtain additional information. Furthermore, given the theorization and significant empirical support for the role of dissonant cognitions in decision making [13], we argue that medication risk from initial cognition (hereafter MRIC) and medication risk from online review content (hereafter MROR) interact with each other. As shown in Table 14, a user's initial cognition about a medication risk has been shaped prior to accessing online reviews. When reading online reviews, the user might find the medication risk to be different than her medication risk from initial cognition. When there is a misfit between MRIC and MROR, a discrepancy is evoked that leads to a state of tension known as cognitive dissonance. As the experience of dissonance is unpleasant, the user is motivated to reduce or eliminate it, and achieve consonance [13]. The need for reducing

cognitive dissonance becomes more significant when a sensitive and risky decision has to be made. In this study, taking medication during pregnancy or lactation is considered a risk-sensitive decision. We argue that two features of online reviews can help individuals to reduce their cognitive dissonance and make less risky decisions. First, by changing a behavioral cognitive element, social verification of the review can help reduce cognitive dissonance. Second, self-verification of the reviewer, can add new cognition for the individual and reduce cognitive dissonance. Moreover, perceived self-efficacy, number of pregnancies, disease type and severity, and demographics are considered as control variables in our model. We collect our data using an online survey.

Considering MRIC and MROR along two continuums anchored on high and low values, a classification of four possible types of interaction can be drawn as shown in Table 14. MRIC and MROR constructs are not expected to co-vary (i.e. vary together) because both are subjectively measured and MRIC has been shaped before receiving MROR. In type 1 and type 4, high degree of MRIC would fit with high and low degrees of MROR, respectively. In type 2 and type 3, low degree of MRIC would fit with low and high degrees of MROR, respectively.

Table 14: Degree of Risk-Sensitive Decision Making based on the Interaction between
MRIC and MROR

Type	Degree of Medication Risk from Initial Cognition (MRIC)	Degree of Medication Risk from Online Review Content (MROR)	Degree of Cognitive Dissonance	Degree of Decision Making Risk	Brief explanation and reasoning
1	High	High	Low	High	Online review confirms user's initial cognition on high medication risk. Although cognitive dissonance is not present, the degree of decision risk is high due to the risky circumstances.
2	Low	Low	Low	Low	Online review content is consistent with user's initial cognition on low medication risk. Cognitive dissonance is not present and the degree of decision risk is low.
3	Low	High	High	High	Online review content is inconsistent with user's initial cognition on high medication risk. Cognitive dissonance is present and the degree of decision risk is high. Hence, user will look for additional clues to reduce cognitive dissonance.
4	High	Low	High	High	Online review content is inconsistent with user's initial cognition on low medication risk. Cognitive dissonance is present and the degree of decision risk is high. Hence, user will look for additional clues to reduce cognitive dissonance.

As shown in Table 14, when MROR is consistent with MRIC, pregnant and breastfeeding mothers might not experience cognitive dissonance. However, we argue that even in the case of cognitive consonance, people might not be confident in their decision making due to the risky circumstances. For instance, when mother's belief about the high risk of medication is confirmed in online reviews, she might still not be confident in her decisions to take the medication.

Hypotheses

From our proposed model we derive three hypotheses. Our first hypothesis focuses on how a user's cognitive dissonance impact her/his risk-sensitive decision making. We explain how a user can experience cognitive dissonance. Then, we elaborate on its influence on risk-sensitive decision making.

Hypothesis 1

Online and offline information do not always confirm each other. This makes distinguishing information from misinformation a complicated and sometimes unnerving task for people. They face uncertainties, risks, and fears they cannot easily analyze [212]. Since lower levels of fit between MRIC and MROR create discrepancy for users, they cannot clearly differentiate between valid information from misinformation [204,212,238]. Hence, they will experience high levels of cognitive dissonance. Hence according to Table 14:

H1a: The lower the fit between the degrees of MRIC and MROR (high/low or low/high), the higher the degree of perceived cognitive dissonance.

Hypothesis 2

There are many things to consider when making risk-sensitive decisions. For example, when making health decisions cost, timing and regularity of medical treatment, potential impact on family, friends and working life are among the main things that should be considered [239]. Risk-sensitive decision making can be overwhelming, time consuming, and emotionally challenging for people. They need to understand the current situation, what they hope to achieve, and what options are available to them to bring about the

desired result [240]. Health decisions can be considered as risk-sensitive decisions as they include unknown possibilities that directly impact people's health [59]. In the quest to make better decisions, people consult experts and their peers [48]. If the information obtained from these two sources are not consistent, people experience cognitive dissonance [13]. Moreover, when people experience high levels of cognitive dissonance they can make riskier decisions [13,51,52]. Integrating the four interaction types previously theorized (see Table 14) for MRIC with MROR, the following outcomes are thought to materialize for the risk-sensitive decision making.

H2a: When the fit between the degrees of MRIC and MROR (high/low or low/high) is low, the higher a user's cognitive dissonance, the higher the degree of decision making risk.

Higher degree of fit between user's medication risk from initial cognition (i.e. MRIC) and medication risk from online review content (i.e. MROR) means users experience less cognitive dissonance. In other words, MRIC is confirmed by MROR. In this case, there are two possibilities as shown in the first two rows of Table 14. First, if a user thinks medication risk is *high*, and online reviews confirm it, the user still has to make a risk-sensitive decision whether to take the medication or not. Thus, the degree of decision making risk is high. However, if the user's cognition of *low* risk medication is confirmed by online reviews, the degree of decision making risk is low.

H2b: When both degrees of MRIC and MROR are high (i.e. high Fit), the lower a user's cognitive dissonance, the higher the degree of decision making risk.

H2c: When both degrees of MRIC and MROR are low (i.e. high Fit), the lower a user's cognitive dissonance, the lower the degree of decision making risk.

Hypothesis 3

Our third hypothesis highlights the effect of the social verification of the review on reducing cognition dissonance. According to cognitive dissonance theory [13], changing behavioral element is one way to reduce cognitive dissonance. To change their behaviors without changing the environment, people would have to be able to find others who would support their new opinion or behavior. In online communities, such support can be found in the form of social-verification of a review. Social verification or social proof is derived from the idea that most individuals are followers rather than initiators and seems to work best when the proof is provided by the actions of many other people [260]. According to the principle of social proof, one way that individuals determine appropriate behavior for themselves in a situation is to examine the behavior of others there, especially similar others [260]. It is through social comparison with referent others that people validate the correctness of their opinions and decisions [13]. As such, social proof or social verification reduces cognitive dissonance [68].

Prior studies have found that people are influenced by the actions of those around them [261]. In fact, individuals often rely on others as a standard of comparison before making decisions [13].

“The validity and functional value of one's thoughts are evaluated by comparing how well thoughts match some indicant of reality. [...] when experiential verification is difficult or unfeasible, social verification is used, with people

evaluating the soundness of their views by checking them against what others believe”[262].

To reduce cognitive dissonance, individuals may look for social support to change their behavioral cognitive element [13]. Moreover, people are more likely to trust and accept the information from the sources that have been positively rated by others [263]. Hence:

H3: The degree of social verification of the review negatively moderates the relationship between cognitive dissonance and risk-sensitive decision making.

Hypothesis 4

Our fourth hypothesis focuses on the impact of “new information” on reducing cognitive dissonance. Based on cognitive dissonance theory [13], people can reduce their cognitive dissonance by adding new information. For example, a pregnant woman’s initial cognition is: *“There is no harm in taking my medication”*. However, she reads in online reviews that “taking her medication might harm her baby”, and experiences cognitive dissonance. Later, she finds new information confirming her initial cognition: *“There is no scientific research on this issue”*. As a result of this new information, her cognitive dissonance may be reduced.

H4a: The degree of new information confirming user’s initial cognition negatively moderates the relationship between cognitive dissonance and risk-sensitive decision making.

New information can come from information about online reviewer. Extant literature has shown that in online communities, reviewer disclosure of identity-descriptive

information is used by people to supplement or replace product information when making decisions and evaluating the helpfulness of online reviews [214]. A variety of different types of personal information can be made available including real name, nickname, geographic location, interests, birthday, or images in reviewers' profile pages. Social identity concerns and beliefs (which refer to individuals' definition of the self in terms of group-defining attributes) have a key role in shaping how recipients perceive the information about the message source when processing messages [71]. Moreover, judgment based on source cues has been referred to as "messenger bias" [264]. Thus attributes of a message source directly influences message recipients' cognition, independent of the message content [265].

In online communities, individuals can feel the pressure to reduce or eliminate their cognitive dissonance due to receiving contradictory information [266]. Typically, reviewers make some personal information such as demographic information available online. More information about reviewers can introduce new cognitive elements [45] and might help people to reduce their cognitive dissonance. For example, people have more trust in the online information sources that they perceive to have higher expertise [267]. Hence:

H4b: The degree of self-verification of the reviewer negatively moderates the relationship between cognitive dissonance and risk-sensitive decision making.

All in all, the research model that emerges as a result of our research (see Figure 12) has "risk-sensitive decision making" as the dependent variable. As it emerges from the review

of extant literature, in particular, significant empirical support has been found for the various relationships between the constructs in our model.

Methodology

We developed the initial set of items in our instrument based on established guidelines in the literature [268]. Next, we refined our instrument. As will be described more fully in subsequent sections, the initial procedure was to have panels of judges sorting items into separate categories, based on the construct definitions. Based on their placement, the items were examined and any inappropriately worded or ambiguous items were eliminated. We then tested our instrument by distributing it to our pilot sample and analyzing the responses to get an initial indication of the scales' reliability and validity. The items that did not contribute to the reliability of the scales were removed. The following sections describe each of the steps in detail.

Phase 1: Construct Conceptualization and Item Development

Step 1: Construct Conceptualization

In the first step, we examined the content validity of our constructs. First, to examine the constructs conceptual domain, all items identified in the existing instruments were categorized according to the various constructs which they were originally intended to address [268]. This generated an initial item pool for each of the constructs. For example, the risk perception literature was examined to review different conceptualizations and operationalizations of individual risk perception.

Second, the actual constructs conceptual domains were identified and refined. For example, initial cognition construct applies to individuals instead of groups or

organization and its general property is cognition or belief rather than behavior or intention. It is considered a subjective, perceptual construct instead of an objective one.

Third, the construct themes including dimensionality, stability, and inclusiveness attributes were identified. For example, a key attribute of initial cognition is belief. Considering the context of our study (i.e. medication risk), initial cognition is operationalized as a construct with three dimensions including individual beliefs about the likelihood of harm, susceptibility to harm, and the severity of harm [64]. Moreover, as we will explain later, we considered all of our constructs to be reflective. Regarding stability, “risk-sensitive decision making” and “cognitive dissonance” are considered as “state” that vary under different environmental conditions. “MRIC” and “MROR” are considered as “belief” about medication risk. “Self-verification of the reviewer” and “social verification of the review” are considered as characteristics of online reviews. As far as inclusiveness is concerned, the specific application context in which the construct is defined was indicated. For instance, cognitive dissonance is defined as a fit between MRIC and MROR and is considered a perceptual measure rather than an objective one. Also, both “self-verification of the review” and “social verification of the reviewer” are defined as user’s perception about these constructs and subjective measures will be used to measure them instead of objective measures. Self-efficacy is defined as general self-efficacy regarding medication use, and not self-efficacy in using IT.

Step 2: Item Generation

Following MacKenzie and Podsakoff’s [268] second step (i.e. item generation), we developed items in line with the conceptualization of each construct. Some constructs were previously validated and only needed minor changes to adopt them to our context

(i.e. medication risk). These constructs include MRIC, MROR, cognitive dissonance, and self-efficacy. Moreover, we generated new items for self-verification of the reviewer, social verification of the review, and risk-sensitive decision making constructs due to lack of previously validated instruments.

Item generation was based on prior research that had included relevant constructs. We created pools of items for each construct by identifying items from existing scales, and by creating additional items, to fit the construct definitions. Then, items considered to be too narrow in focus and applicable only in particular situations were removed. Once this was done, new items were created where it was felt that all dimensions of the construct had not been covered. The typical item in previous instruments tended to be a statement to which the respondent was asked to indicate a degree of agreement. This approach was retained for this study, with a seven-point Likert scale ranging from "extremely disagree" to "extremely agree" chosen as the response format. Once the item pools were created, items for our constructs were then re-evaluated to eliminate those that appeared redundant or ambiguous. Three pregnant/breastfeeding women and three faculty members provided feedback as to the instrument's format and content. At the end of this iterative feedback process, the item definitions were revised to remove academic jargons and provide comprehensible definitions. The wording of some items was also modified.

Perceived Medication Risk from Initial Cognition (MRIC)

In line with the context of our study, perceived medication risk from initial cognition was considered as a proxy to capture user's initial cognition (See Figure 12). Drawing on extant literature, there are three dimensions of medical risk cognition [64]. The first dimension is the perceived likelihood of risk, which is defined as one's probability of being harmed

by a hazard under certain behavior conditions. For example, there can be high likelihood that a person will experience side effects if she takes a medication. Second, perceived susceptibility is used to capture individual resistance or constitutional vulnerability. Third, perceived severity is defined as the extent of harm a medication would cause. As shown in Table 15, the three dimensions of perceived medication risk adapted from Brewer, [64] are also in line with our conceptualization of initial cognition by Festinger [13] as they capture cognition about oneself and the environment.

Table 15: Dimensions of MRIC

Dimension	Definition	Cognition Dimension
Perceived likelihood	The probability that one will be harmed by a medication	Cognition about oneself and the environment
Perceived susceptibility	An individual's constitutional vulnerability to a medication	Cognition about oneself
Perceived severity	The extent of harm a hazard would cause	Cognition about the environment

No construct is inherently formative or reflective and it is ultimately the researcher's approach that determines this choice [268]. We decided to conceptualize MRIC as a reflective second-order construct because its three dimensions (i.e. perceived likelihood, perceived susceptibility, and perceived severity) are not mutually exclusive. For example, if one's perceived susceptibility to medication negative side effects is high, her/his perceived severity of medication negative side effects is likely to be high.

Perceived Medication Risk from Online Review (MROR)

Here, we define MROR as cognition about medication risk that is acquired from peer-generated evaluations posted on online communities [67]. In order to be consistent in our measurement, we measure MRIC and MROR with the same dimensions.

Fit between MRIC and MROR

Based on the possible interactions between MRIC and MROR (see Table 14), a closer look at the very nature of their relationship is necessary in order to ensure that there is a strong correspondence between the conceptualization and the operationalization of this fit. Carefully examining the validity of the choice of how a fit construct is formulated and statistically tested in empirical research is a critical step in linking theory building to theory testing [269]. Out of a total of six (6) types of fit theorized to exist in extant literature (cf. Figure 2), three (3) of them, namely *Fit as Moderation*, *Fit as Mediation*, and *Fit as Profile Deviation* are thought to be criterion-specific. They represent cases where the fit is intrinsically connected to a specific dependent variable, as opposed to instances where the fit follows a criterion-free specification as per *Fit as Matching*, *Fit as Covariation*, and *Fit as Gestalts*. In this study, there is no criterion because MRIC (i.e. independent variable) is connected to “Fit” which is not a dependent variable. Therefore, “fit as matching” was used to measure the “Fit” between MRIC and MROR. The absolute values computed from $|MRIC_i - MROR_j|$ indicate degree of misfit. To obtain degree of fit, a misfit value was transformed by subtracting it from $K=7$, so that a higher value represents a better fit. For example, in the case of $MRIC_1 = 7$ and $MROR_1 = 1$, the value of misfit is 6 (i.e. $7 - 1$) and the value of fit through the conversion is therefore 1 (i.e. $7 - 6$). $Fit = K - |MRIC_i - MROR_j|$.

Cognitive Dissonance

In line with prior work [65], we subjectively measure the fit between MRIC and MROR. We have developed three items based on the conceptual definition of this construct (i.e. the fit between user's initial cognition and online review content regarding medication risk). To measure cognitive dissonance, self-measures were used instead of objective measures of fit [269] since our goal was to capture user's own perceptions of cognitive dissonance. Initial items were adapted from prior research [65] and revised to measure the expectation versus reality for three medication risk dimensions including the likelihood of harm, susceptibility to harm, and the severity of harm.

Social Verification of the Review

Social verification of the review or social proof is derived from the idea that most individuals are followers rather than initiators and seem to work best when the proof is provided by the actions of many other people [68]. It is defined as looking to the actions of others for clues as to what constitutes appropriate action [67,68]. In line with extant literature, we measured social proof by the number of likes/helpfulness ratings associated with an online review. It is a subjective measure. Therefore, we ask subjects to recall whether the number of likes or helpfulness ratings of the online reviews were high or low.

Self-Verification of the Reviewer

For measuring self-verification of the reviewer, we followed the suggested operationalization guidelines available in the extant literature. It is a multidimensional construct and is defined as the depth and breadth of information about the reviewer that s/he makes available to others such as profile data, in online communities [71,214]. Based on this understanding and categories of self-disclosure items [71,214], survey items for self-verification of the reviewer are developed for this study. Most relevant categories of

self-disclosure items include personal information on activities and interests, photos, work, education, age, contact information, and relationship status were used to create survey items. Based on our context, we added prior pregnancies as an additional category.

New Information

In this work, new information is defined as information about the medication risk that has been obtained recently. Such information can confirm or disconfirm a person's initial cognition on medication risk. To reduce cognitive dissonance, the new information should confirm a person's initial cognition on the medication risk [13]. However, we argue that if the new information disconfirms the initial cognition, cognitive dissonance may be increased. In order to be consistent in our measurement, we measured new information about the medication risk with the three dimensions of medication risk including: likelihood and severity of medication harm, as well as susceptibility to medication harm. Initial items were adapted from prior research [65].

Risk-Sensitive Decision Making

As we previously discussed and in line with prior work [52], we define decisions as riskier to the extent that “(a) their expected outcomes are more uncertain, (b) decision goals are more difficult to achieve, or (c) the potential outcome set includes some extreme consequences” [52]. Consider, for example, a breastfeeding woman with seasonal allergies. Given her personal characteristics such as medical history, age, physical condition, etc., she might choose among various over-the-counter medication for her allergy. If she is not aware of the potential adverse outcomes of the medication, there is risk in choosing or taking a medication.

For construct operationalization, three dimensions of the construct were adapted from prior research [52], including outcome uncertainty, outcome expectations, and outcome potential. We then created five items based on these dimensions: (1) my decision could have diverse outcomes, (2) my decision could have uncertain outcomes, (3) my decision could have extreme outcomes, (4) my decision outcomes could be disappointing, and (5) I was unsure about the likelihood of my decision outcomes. The first four items are related to “outcome uncertainty” dimension. The fifth and sixth items are related to “outcome expectations”, and “outcome potential” dimensions, respectively. The items were measured on a 7-point scale and validated in a process that is elaborated in the instrument development section (see Table 28 in Appendix B).

Control Variables

Informed by the decision risk and health decisions literature, different factors related to the decision, health status, and individual differences can potentially influence risk-sensitive decision making. We used number of past pregnancies (N_Preg) and general self-efficacy¹⁰ (SEF) as our control variables. Table 16, provides an overview of our model’s constructs and their measurement approaches.

Table 16: Construct Definitions and Measurement Approach

Construct	Definition	Measurement	Ref.
MRIC	Cognition about medication risk on oneself	Drawing on Table 15, MRIC is measured as pregnant and breastfeeding women’s perceived medication risk.	Adapted from prior work [13,64]

¹⁰ It is different from IT self-efficacy.

MROR	Cognition about medication risk on oneself that is acquired from peer-generated evaluations posted on online communities [67].	We use measurement items similar to MRIC	Adapted from prior work [13,64]
Fit	Fit as matching between MRIC and MROR	$\text{Fit} = K - \text{MRIC}_i - \text{MROR}_j $.	Adapted from prior work [269]
Cognitive Dissonance	The perceived fit between user's initial cognition and online reviews on medication risk.	Subjective measure of fit between MRIC and MROR	The measure is developed in this study and is in line with prior work [65]
Social Verification of the Review	Looking to the actions of others for clues as to what constitutes appropriate action.	Social verification or social proof is derived from the idea that most individuals are followers rather than initiators and seems to work best when the proof is provided by the actions of many other people. We measure social proof by the number of likes/helpfulness ratings associated with an online review.	Adapted from prior work [67,68]
New Information	New information confirming user's initial cognition	To be consistent with MRIC and MROR, we used the dimensions of those constructs to measure new information	Adapted from prior work [13]
Self-verification of the Reviewer	The depth and breadth of information that the reviewer makes available to other users in the online community about her/himself such as profile data, preferences, etc.	We followed the suggested operationalization guidelines available in the extant literature that sees the concept as a multidimensional construct which needs to be assessed in terms of depth and breadth of information that the reviewer makes available to other users in the online community about himself. Most relevant categories of self-disclosure	Adapted from prior work [71]

		items from prior work [13,71] including personal information on activities and interests, photos, work, education, age, contact information, and relationship status were used to create survey items. Based on our context, we added prior pregnancies as an additional category.	
Risk-Sensitive Decision Making	Decision are riskier to the extent that “(a) their expected outcomes are more uncertain, (b) decision goals are more difficult to achieve, or (c) the potential outcome set includes some extreme consequences”	Construct dimensions (i.e. outcome uncertainty, outcome expectations, and outcome potential) were adapted from prior work [52] and items were developed in this study	The measure is developed in this study and is in line with prior work [52]
Control Variable: Self-efficacy	Self-efficacy, defined as “beliefs in one’s capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands” [270]	Subjective measure of general self-efficacy adapted to our context.	Adapted from prior work [72]

Where modifications of measurement instruments were required, as well as in instances where new measures were necessary, due diligence has been undertaken to ensure valid and reliable operationalization. As such, the first phase of measurement instrument refinement includes a content validation effort that involved practitioners and faculty members providing review as to the instrument’s appearance and content. Next, preliminary construct validation has been done using card sorting [271,272] to obtain an initial assessment of construct validity. Thirty raters were given the conceptual definitions for all the constructs in our model along with their measurement items. They were then

asked to sort the items based on which underlying construct they believe it measures. The card sorting exercise helped refine the measurement instrument by allowing for the modification of the items.

Step 3: Content Validity

The goals of this stage were twofold: to assess the construct validity of the various scales being developed, and to attempt to identify any particular items which still may have been ambiguous. The content validity of the measures was assessed via three rounds of card sorting analysis. As discussed earlier, except self-efficacy, all the other constructs' items were originally developed in this study. Self-efficacy items were adapted to our context (i.e. medication risk).

Card Sorting

To establish content validity as well as preliminary convergent and discriminant validity, we performed three rounds of card sorting with 30 academic experts and pregnant/breastfeeding women forming three panels of 10 judges. Sample size of 30 judges is preferred to achieve about 80% power to detect a problem that occurs in 5 % of the population and a repeat occurrence of a problem that affects 10 % of the respondents [273]. In all sorting rounds, a different set of judges was used. Each set included IS doctoral students and faculty members, and pregnant/breastfeeding women. This range of backgrounds was chosen to ensure that a range of perceptions would be included in the analysis. In each panel, judges were asked to sort the various items into construct categories. We asked judges to sort the items into separate categories that had been previously labeled. They were invited to participate by an email with a note that described the exercise's goal and details as well as a link to the card sorting page.

As shown in Appendix C, the experts followed the link landed on an HTML page. To make card sorting easier for judges, constructs and their definitions were always shown on top of the page throughout the whole card sorting exercise. All measurement items were displayed one at a time, in random order. Judges had to associate items as they were presented to them with a particular category that they believe the item best reflects. Moreover, A category labeled “Don’t know/Unrelated” was considered as a category for the judges to place in it measurement items that for some reason cannot be categorized. Two control questions were also added to make the card sorting activity more reliable. The questions are: “It is a validation question. Please select "Risk-sensitive decision making" as your answer choice” and “It is a validation question. Please select "Online Review" as your answer choice”.

The judges’ responses provided valuable feedback on rewording items for improving their relevance and clarity. We also added two control ‘measurement’ items. Ideally, these should be placed in the “Don’t know/Unrelated” category and we believe that misplacing these items would be indicative that the judge did not perform the sorting in a careful or competent manner. The control items were worded in such a way as not to reflect any of the constructs under scrutiny. For instance, “If you are reading this question, please select the third choice” was included as the control measurement item. At the end of the exercise, to further identify problematic items, judges were asked to comment on the ambiguous items and provide feedback on the whole card sorting exercise.

Card sorting examines how well judges place items in the provided categories. It helps to revise or eliminate ambiguous items and includes two steps. First, hit ratio -the percentage of people that properly placed an item- is calculated. Second, the number of

items that were misplaced in other categories and the number of items from other categories that were misplaced in a category are calculated. By comparing the categories developed, we were able to assess the domain coverage of the particular construct. A second indicator of construct validity was the convergence and divergence of items within categories. If an item was consistently placed within a particular category, then it was considered to demonstrate convergent validity with the related construct, and discriminant validity with the others [274,275].

In Appendix C, Table 29, Table 30, and Table 31 show the summary results of the three rounds of card sorting. This led to several revisions for example item re-wording for consistency and clarification, item elimination, and construct redefinitions when found ambiguous. For example, the conceptualization of risk-sensitive decision making was revised, its previous items were deleted, and new items were proposed based on the three dimensions of the construct (i.e. outcome uncertainty, outcome expectations, and outcome potential). Deleted measurement items include:

- 1- If I were not pregnant or breastfeeding, I would decide to take the medication.
- 2- I consider my decision about the medication a risk-sensitive decision.
- 3- I am sure that I will experience negative side effects if I decide to take this medication.

New items include:

1. My decision could have diverse outcomes.
2. My decision could have uncertain outcomes.
3. My decision could have extreme outcomes

4. My decision outcome could be disappointing.
5. I was unsure about the likelihood of my decision outcomes.

After the third round of card sorting, the hit ratio improved from 64.8% to 92.5%.

Pre-Testing and Pilot-Testing of the Measurement Instrument

In order to test the survey, we sat with three pregnant/breastfeeding women with recent experience in using online reviews about their medications. The interviews were conducted face-to-face, over Skype, or by phone. Participants were asked to complete the survey and think out loud about how they felt about the questions, the clarity, the format, and the look and feel of the survey. Moreover, to identify any other potential issues with the survey content or survey administration procedures and to provide the necessary data for the Exploratory Factor Analysis (EFA) exercise [276], we conducted an initial pilot test including a randomly selected group of 100 participants from Amazon Mechanical Turk. According to prior literature, 30 representative participants from the population of interest is a reasonable minimum recommendation for a pilot study where the purpose is preliminary survey or scale development [211,277]. To decrease the length of confidence interval (CI) as sample size increases for a range of item lengths at Cronbach's $\alpha = 0.70$, we chose to include 100 participants for our pilot test and factor analysis. More details are provided in the results section.

Once our pilot test responses became available, Confirmatory Factor Analysis (CFA) was conducted as a way of assessing first, convergent validity, or to verify that every item loads on its appropriate construct and does not seem to be split between two or more constructs; and second, discriminant validity, or that the measure is indeed novel and not simply a reflection of some other variable. The scales' reliability, or their Cronbach's alpha

readings, were verified against the 0.70 [278] level that is considered acceptable for field research in a bid to ensure that there is little variation in the construct's measurement that is due to random chance or errors. Finally, the average variance extracted (AVE) by the measurement items were checked against the 0.50 [279] benchmark commonly used in extant literature to ensure that they adequately capture and account for enough of the variance in the constructs they are intended to measure. More details are provided in the results section.

Step 4: Predictive Validity

Predictive validity is a method to examine whether measures behave in accordance with the theory [269]. Thus, for construct validity purposes, it is necessary to examine the behavior of the “risk-sensitive decision making” measure with measures of theoretically related constructs in its nomological network. In this study, the predictive validity of the “risk-sensitive decision making” construct is established by replacing our proposed construct in a theoretically-related model. Prior work [52] proposed a model for risky decision making behavior. As shown in Figure 13, to examine the predictive validity of our “risk-sensitive decision making” construct, we used a proposed model from previous research [52] and replaced its dependent variable (i.e. risky decision making behavior) with our dependent variable (i.e. “risk-sensitive decision making”). Construct definitions and items are borrowed from prior work [52] and shown in Table 17. The result of the predictive validity test is presented in the Results chapter, in the Preliminary Analysis section.

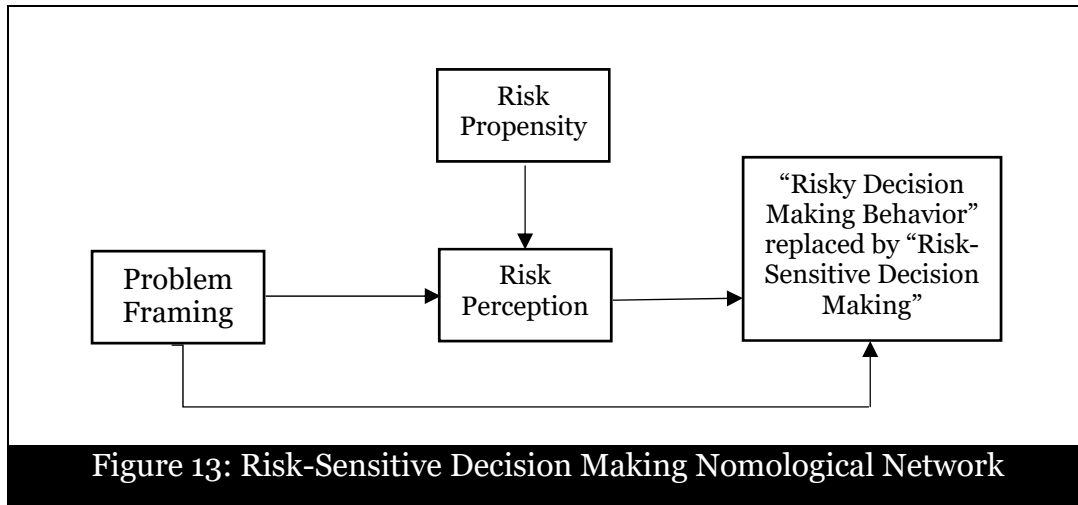


Table 17: Predictive Validity - Construct Definitions

<i>Construct</i>	<i>Definition</i>	<i>Items</i>
<i>Problem Framing</i>	Whether a situation is presented to a decision maker as an opportunity or a threat, or in terms of gains or losses.	<p>"Future opportunities to improve my health were key, even though they were uncertain"</p> <p>"This was the biggest opportunity I ever had to improve my health"</p> <p>"I just had to go for it—you can't win by sitting in the pits"</p> <p>A seven-point scale ranging from strongly disagree to strongly agree.</p>
<i>Risk Propensity</i>	An individual's current tendency to take or avoid risks.	<p>"Considering your decision about the medication, how would you rate your tendency to</p> <ul style="list-style-type: none"> Choose more or less risky alternatives based on the assessment of others on whom you must rely Choose more or less risky alternatives which rely upon complex analyses Choose more or less risky alternatives which could have a major impact on your health Initiate an action related to your medicine which has the potential to backfire Support a decision when you were aware that relevant analyses were done while missing several pieces of information
<i>Risk Perception</i>	An individual's evaluation of how risky a situation is	<p>"How would you characterize your decision about the medication?"</p> <ul style="list-style-type: none"> 1 = significant opportunity to 7 = significant threat; 1 = potential for loss to 7 = potential for gain 1 = positive situation to 7 = negative situation <p>"What is the likelihood that your decision about the medication is satisfactory?"</p> <p>1 = very likely to 7 = very unlikely</p>
<i>Risky Decision-Making Behavior</i>	The degree that individuals are willing to take the risk in their decision making	<p>"What is the probability that you would decide to take/not take the medication?"</p> <p>(where 0% = definitely not take and 100% = definitely take)?" Choices were provided in increments of 10 percent.</p>

Phase 2: Cross Sectional Survey

After developing the instrument, the second phase of this study aimed at testing the revised model by conducting a cross-sectional survey. In the following, further details are provided.

Sampling and Data Collection

The data collection process relied upon individual answers provided via a secure, web-based survey, created and administered in Qualtrics (see Table 28). The unit of analysis was individual. The study's sample frame was composed of pregnant and breastfeeding women who use online reviews regarding a medication they want to use during pregnancy or breastfeeding. Subjects were deemed qualified to fill out the survey if they self-declared that they were pregnant or breastfeeding and resided in the United States at the time they were taking the survey. Respondents were provided with explanations on the goal of study and its conditions (e.g., its voluntary nature, their anonymity, aggregate form reporting).

Respondents were also screened to meet certain criteria before the start. Two screening questions asking “In which stage of the pregnancy are you now??” and “When are you due?” were added to the survey. If the answers to these two questions did not match, the subject were not allowed to take the survey. Moreover, different quality-control questions were added to the survey to ensure that respondents were paying attention to the questions and responses. Reverse-coded questions were also used in order to improve the quality of responses. To reduce ambiguity, we included guidelines and several definitions of the construct definitions using boxes or pictures on the survey page. Invisible timers were included in the survey especially for the key independent and dependent variables to ensure that respondents were not speeding through the survey. Each response was also

checked with respect to speeding (time stamped for several questions including the dependent and independent variables) and straight-lining. Finally, we had controls to ensure that no respondent could participate in the responses more than once. No more than 10 minutes was necessary to answer the survey.

For the actual survey, drawing on extant literature [280] and prior empirical studies [65,216] that contain constructs theoretically related to one's cognitive dissonance, a sample size of 400 respondents was deemed appropriate. According to past research [281], since we had 34 parameters including control variables in our actual survey, a minimum of 340 respondents were required. Moreover, based on previous research regarding the impact of peers on risk-sensitive decisions making [282], we used 0.3 as the effect size in our analysis. GPower software¹¹ was used for sample size calculation. We considered the power of the test as 80%, effect size as 0.3, and the “ α error probability” as 0.01. Based on GPower results, the minimum sample size was 82 subject. Therefore, the sample size of 400 is large enough given the 82 threshold.

We used Amazon Mechanical Turk to recruit respondents. Amazon MTruk has been shown to have reliable, high quality, and inexpensive data [283]. Our survey were only visible to people who have identified themselves as woman in their Amazon MTurk profile. Also, using IP addressed in Qualtrics, we screened out those participants whose locations where not in North America. Information and Consent Form to recruit participants are shown in Appendices D and E. Once people qualify and agree to participate in our study, they had 10 minutes to answer questions in our online survey (see Appendix B). At the end of survey they were compensated \$1 USD. At the beginning

¹¹ <http://www.gpower.hhu.de/>

of the survey, we asked the subjects to recall the most recent time (i.e. within the last two years) that they have accessed online reviews about taking a medication during their pregnancy or breastfeeding period. Then, we asked them survey questions on “risk-sensitive decision making”, MRIC, MROR, “cognitive dissonance”, “social verification of the review”, “new information”, “self-verification of the reviewer” constructs, control variables, and the items in the nomological network, respectively. The survey included a number of “attention” questions such as “If you are reading this question please select “To some extent”.

Survey Design

The survey design and data collection procedures were developed based on the recommendations in prior work [274,275]. The survey questions were sorted in several segments based on concepts (e.g., risk-sensitive decision making, cognitive dissonance, and demographic questions). To reduce cognitive load and mental exhaustion, we used a concept-centric sorting of the questions in contrast to randomizing them [284].

Internet survey participants are motivated by material incentives, opportunity to contribute to research, curiosity, and self-knowledge [285]. Compared to traditional offline surveys, web-based surveys are cheaper, have higher response speed, and provide access to more geographic locations [286]. Best practices from offline surveys were used for our online survey. More specifically, our web-based survey was designed to be respondent friendly questionnaire that was easy to access and to navigate with the most commonly used web browsers on the market, including Internet Explorer, Firefox,

Chrome, Safari, and Opera. Using an online readability site¹², the assessment indicates the current reading level is standard/average, it would take a grade fifth and sixth educational level to understand this survey. Similar to traditional surveys, this due diligence is necessary in order to minimize misunderstanding, facilitate the response process, and eliminate responder aggravation. Appendix B shows the final version of the survey.

Data Analysis

PLS as the Statistical Tool

We chose to use partial least square (PLS) techniques rather than covariance-based structure equation modeling (CBSEM) for several reasons. First, PLS has been recognized as a more appropriate tool for less theoretically developed domains. In contrast, CBSEM is more suitable for more theoretically developed areas [287]. Second, PLS is less sensitive to the violation of normality assumption. Third, PLS allows working with smaller sample size, which is not the case with CBSEM. Based on the rule of thumb in PLS, “the sample should have at least ten times more data-points than the number of items in the most complex construct in the model”—i.e., self-efficacy with 8 items. This led to a minimum of 80 responses. However, the rule of thumb of CB-SEM (i.e., ten times the number of free parameters) requires the collection of more than 850 responses (calculated by the number of questions times two plus the number of paths). While our sample size (i.e. 400) was more than the minimum required in PLS, it was less than CB-SEM required sample size. Thus, we used SmartPLS 3.0 software for our data analysis.

¹² <http://www.readabilityformulas.com/free-readability-formula-tests.php>

Preliminary Data Analysis

We initially conducted a data screening step that included analyzing outliers, testing for normality, and analyzing descriptive statistics.

Missing Value

Based on the options provided by the data collection platform (i.e. Qualtrics), respondents were not able to progress if a question was left unanswered. Therefore, missing values were not an issue in our data.

Multivariate Normality

Our data were not normally distributed in some of the variables of our proposed model. In particular, some questions in social-verification of the review and in self-efficacy were negatively skewed. PLS has been argued to be robust against deviation from normality. However, we transformed those data variables that were not normally distributed. Data transformation did not impact our results' significance. As such, there was no violation of the normality assumption in our analysis.

Reducing Bias

A common criticism of statistical analyses using self-reported data is the problem caused by recall error. When people remember past events, they often don't have an accurate picture of what happened. A common strategy to reduce recall bias is to choose short recall windows, however, there is no general answer to the question of optimal recall window [288]. To mitigate recall bias, we used a number of strategies. First, we asked the participants to recall their most recent experience within the last two years. Second, we

controlled for issues that have been known to influence participant's recall such as age, education, socioeconomic status, and number of pregnancies.

As we measured both dependent (i.e. risk-sensitive decision making) and independent variables of our model from the same participants, there is a risk of common method bias [288–290]. To control for common method bias we followed three design procedures and one statistical procedure to further reduce common method bias as described in the next two sections.

Procedural Remedies

Temporal, proximal, and psychological separation of independent and dependent variables are suggested in the extant literature to reduce common method bias [288,291]. Therefore, first, we separated the questionnaire sections that measured different independent and dependent variables. Second, we measured a relevant, yet theoretically unrelated variable (i.e., a market variable) to help psychologically deviate a respondent's attention to an unrelated concept. However, we did not make the distance so large as to not enable method-related factors to affect the level of independent variable and to lower the rate of attrition [268,288]. Third, as a key source of common method bias, we went through several rounds of card sorting and pre-testing of the question items to ensure that they asked simple and specific questions, did not include ambiguous terms, included examples for clarifications, and were not interpreted as double-barreled questions. We also ensured that all the points on the response scale were labeled [292]. Fourth, respondents were not being allowed to submit incomplete information by avoiding or skipping parts of the questionnaire that is presented to them [274,275]. Fifth, the survey used built-in Qualtrics functionality based on cookies and IP tracking logs to ensure that

respondents did not submit multiple surveys [293]. Sixth, online survey respondents typically are more motivated to provide answer when they receive fair compensation [294]. Hence, based on the minimum wage in the U.S (i.e. \$7.25 per hour in 2018¹³), we provided a financial incentive of \$1 to those who completed and submitted the survey.

Statistical Remedies

We employed two statistical methods to test whether common method bias was a threat to the study's result and conclusions. First we conducted the Harman single factor test [288], a diagnostic test for common method variance. All the variables of the study were entered into an exploratory factor analysis using SPSS's un-rotated principle component factor in order to determine the number of factors necessary to account for explaining the variance. As shown in Table 18, the Harman test extracts seven factors with eigenvalues over 1.0 and 74.44% as the total variance explained. The result showed that the common factor contributed to 22.244% of the explained variance which does not account for the majority of the variance and is well below the threshold of 50% [295]. Hence, common method bias is not present based on the Harman single factor test.

Table 18: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.228	22.244	22.244	6.228	22.244	22.244
2	4.603	16.439	38.683	4.603	16.439	38.683
3	2.910	10.392	49.075	2.910	10.392	49.075
4	2.562	9.150	58.225	2.562	9.150	58.225
5	1.790	6.394	64.618	1.790	6.394	64.618
6	1.414	5.051	69.670	1.414	5.051	69.670
7	1.336	4.771	74.440	1.336	4.771	74.440
8	.943	3.368	77.808			
9	.893	3.188	80.996			
10	.744	2.658	83.655			
11	.664	2.372	86.027			

¹³ <https://www.dol.gov/general/topic/wages/minimumwage>

12	.511	1.824	87.851			
13	.480	1.716	89.567			
14	.433	1.547	91.114			
15	.379	1.355	92.469			
16	.360	1.284	93.754			
17	.305	1.090	94.843			
18	.285	1.019	95.862			
19	.219	.781	96.644			
20	.188	.671	97.314			
21	.146	.522	97.836			
22	.141	.505	98.341			
23	.129	.462	98.803			
24	.099	.353	99.156			
25	.083	.297	99.454			
26	.071	.253	99.707			
27	.052	.187	99.893			
28	.030	.107	100.000			

Extraction Method: Principal Component Analysis.

Second, a latent variable correlation matrix was also examined. Common method bias could be an issue, if there was a very high correlation (around 0.90) among the latent variables. As shown in Table 19, the highest correlation in the matrix was -0.534 between CD and Fit. Thus, common method bias was not an issue in our data.

Table 19: Latent Variable Correlation Matrix

	CD	FD	Fit	NIC	N_Preg	RSD	SEF	SeV	SoV
CD	1.000								
FD	-0.008	1.000							
Fit	-0.534	-0.030	1.000						
NIC	-0.369	-0.002	0.356	1.000					
N_Preg	0.160	-0.076	0.030	-0.015	1.000				
RSD	0.195	0.173	-0.155	0.153	-0.035	1.000			
SEF	-0.039	-0.185	0.044	0.073	0.127	-0.241	1.000		
SeV	-0.026	0.077	-0.022	-0.022	0.098	-0.205	0.052	1.000	
SoV	0.100	-0.109	-0.028	-0.031	0.092	-0.241	0.162	0.122	1.000

CD: Cognitive Dissonance; **FD:** Final Decision; **Fit:** Euclidian distance between MRIC and MROR; **MRIC:** Perceived Medication Risk from Initial Cognition; **MROR:** Perceived Medication Risk from Online Review Content; **NIC:** New Information Confirming Initial Cognition; **N-Preg:** Number of Past Pregnancies; **RSD:** Degree of Risk Sensitive Decision Making; **SEF:** Self-efficacy; **SeV:** Self Verification of the Reviewer; **SoV:** Social Verification of the Review.

Pilot Test Findings

Pilot Test Descriptive Statistics

The pilot test sample included 100 respondents, out of which 27% were 18-29 years old, 64% were 30 to 39 years old, and 9% were 40 years or older. Moreover, 56% of the pilot test sample hold a bachelor's degree, while others hold a graduate (5%), high school (4%), or some college education, but no degree (35%). Moreover, 26% of the pilot test respondents have been pregnant or breastfeeding less than two years prior, 71% were breastfeeding and 3% were pregnant when they participated in the pilot test.

Measurement Model Validation

This section involves checking for reliability and validity of the model.

Measurement Model Reliability

Indicator Reliability

Different measures were used to enhance the reliability of our instrument including indicator reliability. Reliability of the item measures for the constructs represent the percentage of the amount of indicator variance that is explained by its respective latent variable [73]. Cronbach's alpha and Dillon-Goldstein's Rho coefficient (for composite reliability) measures were used to assess our instrument's reliability [73]. Table 21 shows that the Cronbach's alpha and composite reliability measures for all items except self-verification of the reviewer (SeV) are over the conservative threshold of 0.70, which indicates a very good construct reliability [73]. Also, all AVEs except SeV are above the 0.50 threshold [73].

Table 20: Composite Reliability and Cronbach's Alpha

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CD	0.943	0.962	0.963	0.898
FD	1.000	1.000	1.000	1.000
Fit	0.802	0.803	0.884	0.717
NIC	0.939	0.978	0.955	0.841
N_Preg	1.000	1.000	1.000	1.000
RSD	0.805	0.808	0.866	0.565
SEF	0.877	1.151	0.893	0.516
SeV	0.614	0.822	0.719	0.484
SoV	0.717	-1.818	0.163	0.217

As shown in Table 21, for most of measurement items the factor loadings were more than the 0.50 benchmark [296]. Among all, items of four constructs had less than 0.50 loadings: SeV1 (0.451), SoV1 (0.052) and SoV2 (0.163). After removing SeV1 and SoV2, all factor loadings remained above the 0.50 cut off point, while SoV1 also improved (0.515). Therefore, we kept SoV1 in the model. The 0.50 cut off point [296] was preferred over 0.70 [287] since the ratio between the number of observations to our total number of items was 3 to 1, which was less than the 5 to 1 minimum ratio suggested in prior work [297].

Table 21: Cross Loadings

	CD	FD	Fit	NIC	N_Preg	RSD	SEF	SeV	SoV
CD_1	0.964	-0.008	-0.553	-0.360	0.095	0.200	-0.049	-0.026	0.050
CD_2	0.926	-0.037	-0.436	-0.327	0.163	0.101	-0.058	-0.057	0.136
CD_3	0.953	0.017	-0.514	-0.360	0.203	0.236	-0.009	0.003	0.108
FD	-0.008	1.000	-0.030	-0.002	-0.076	0.173	-0.185	0.077	-0.109
Fit_1	-0.458	-0.031	0.885	0.183	-0.007	-0.219	-0.026	-0.033	0.002
Fit_2	-0.452	0.110	0.824	0.447	0.022	0.002	0.091	0.072	-0.116
Fit_3	-0.445	-0.156	0.831	0.274	0.062	-0.177	0.047	-0.095	0.044
NIC_1	-0.425	-0.003	0.437	0.879	0.034	-0.079	0.094	0.062	0.011
NIC_2	-0.351	0.029	0.319	0.939	0.002	-0.161	0.108	0.019	-0.054
NIC_3	-0.300	-0.010	0.290	0.918	-0.022	-0.130	0.089	-0.082	-0.017
NIC_4	-0.322	-0.027	0.314	0.932	-0.048	-0.160	-0.005	-0.051	-0.031
N_Preg	0.160	-0.076	0.030	-0.015	1.000	-0.035	0.127	0.098	0.092
RSD_1	0.108	0.209	-0.126	0.120	0.044	0.793	-0.226	-0.026	-0.277
RSD_2	0.168	0.126	0.026	0.165	0.044	0.744	-0.123	-0.142	-0.153
RSD_3	0.163	0.039	-0.152	0.242	0.008	0.825	-0.141	-0.194	-0.133
RSD_4	0.143	0.121	-0.105	0.108	-0.074	0.727	-0.208	-0.225	-0.138
RSD_5	0.152	0.156	-0.237	-0.081	-0.170	0.659	-0.212	-0.189	-0.204
SEF_1	-0.188	-0.096	0.160	0.086	-0.091	-0.172	0.632	-0.024	-0.048
SEF_2	-0.041	-0.007	0.059	0.163	0.028	-0.138	0.532	0.074	0.108
SEF_3	-0.028	-0.073	0.062	-0.006	0.132	-0.186	0.732	0.014	0.053
SEF_4	-0.039	-0.027	0.104	0.055	0.060	-0.236	0.800	0.084	0.136
SEF_5	0.039	-0.246	-0.032	0.064	0.217	-0.183	0.879	0.094	0.192
SEF_6	-0.052	-0.093	0.046	0.055	0.024	-0.259	0.817	0.009	0.152
SEF_7	0.009	-0.010	0.074	0.008	0.019	-0.142	0.557	0.000	0.159
SEF_8	-0.037	-0.095	0.020	0.057	0.059	-0.150	0.723	0.009	0.158
SeV_1	0.032	0.028	-0.135	-0.004	0.173	-0.004	0.064	0.451	0.052
SeV_2	-0.100	-0.073	-0.024	-0.085	-0.056	-0.081	0.084	0.587	-0.019
SeV_3	0.007	0.119	-0.014	0.006	0.134	-0.212	0.029	0.951	0.151
SoV_1	0.149	-0.014	-0.095	0.204	0.190	-0.032	0.117	-0.001	0.052
SoV_2	0.183	-0.015	-0.162	0.136	0.139	0.103	0.081	0.049	-0.163
SoV_3	0.194	-0.109	-0.125	0.026	0.145	-0.137	0.182	0.150	0.788

After removing SeV1 and SoV2, we ran another round of factor analysis. The updated factor analysis is provided in Table 22. In this table, off-diagonal values are correlations among the factors and diagonal values are the square roots of the AVEs. Our updated

results are in line with Fornel-Larcker Criterion in that in any given factor, the square root of AVE is greater than any of its inter factor correlations.

Table 22: Updated Factor Analysis

	CD	FD	Fit	NIC	N_Preg	RSD	SEF	SeV	SoV
CD	0.948								
FD	-0.008	1.000							
Fit	-0.534	-0.030	0.847						
NIC	-0.370	-0.002	0.356	0.917					
N_Preg	0.160	-0.076	0.030	-0.015	1.000				
RSD	0.195	0.169	-0.151	-0.158	-0.034	0.751			
SEF	-0.039	-0.185	0.044	0.073	0.127	-0.240	0.718		
SeV	-0.028	0.075	-0.020	-0.024	0.093	-0.210	0.053	0.792	
SoV	0.212	-0.101	-0.136	0.074	0.178	-0.130	0.193	0.132	0.776
Crnbch's a	0.943	1.000	0.802	0.939	1.000	0.805	0.877	0.741	0.714
CR	0.963	1.000	0.884	0.955	1.000	0.865	0.893	0.762	0.734

Crnbch's α: Cronbach's Alpha; **CR:** Composite Reliability

Measurement Model Validity

Convergent Validity

All constructs were tested for convergent validity which is the degree to which different measures of the same construct that are supposed to be related are actually related. We did so by examining item-to-construct loadings, composite reliability, and average variance extracted (AVE) [289]. As indicated in Table 21, all of the item-to-construct loadings were greater than 0.50, which indicates the variance explained exceeds the error variance [296]. Second, examination of the cross-loadings of items on other constructs showed that all items loaded higher on their associated constructs and not others [298]. Third, all the values of composite reliability and Cronbach's Alpha measures were higher than the recommended threshold of 0.70, and the values of AVE were all above 0.50 [289].

Discriminant Validity

As a test at the item level, discriminant validity is “assessed by checking that the AVE of each construct is larger than its correlation with the other constructs, and that each item has a higher loading (calculated as the correlation between the factor scores and the standardized measures) on its assigned construct than on the other constructs” [299]. As shown in Table 21, our measures passed this test and all the constructs are correlated highly with their item, rather than other items. In other words, each item loaded higher on its principal construct than on other constructs. In addition to the item-level test at the construct level [289], Table 22 shows that the AVE for each associated construct was significantly larger than the squared correlation between that construct and other latent variables. This provided additional evidence for discriminant validity.

Full Test Findings

Full Test Descriptive Statistics

The full test sample included 400 respondents, out of which 22% were 18-29 years old, 66% were 30 to 39 years old, and 12% were 40 years or older. Moreover, 45% of the full test sample hold a bachelor's degree, while others hold a graduate (7%), high school (17%), or some college education, but no degree (31%). Also, 36% of the full test respondents have been pregnant or breastfeeding less than two years prior, 59% were breastfeeding and 5% were pregnant when they participated in the full test.

Predictive Validity Findings

In order to test the predictive validity, we initially ran the data in SmartPLS 3.0 to examine whether our dependent variable (i.e. risk-sensitive decision making) can be predicated by theoretically related antecedents [52]. As shown in Figure 14 and

Table 23, both relationships between Problem Framing -> RSD; and Risk Perception -> RSD are significant at 0.05 level which means that our proposed construct (i.e. RSD) can be predicted by its relevant antecedents from the literature [52].

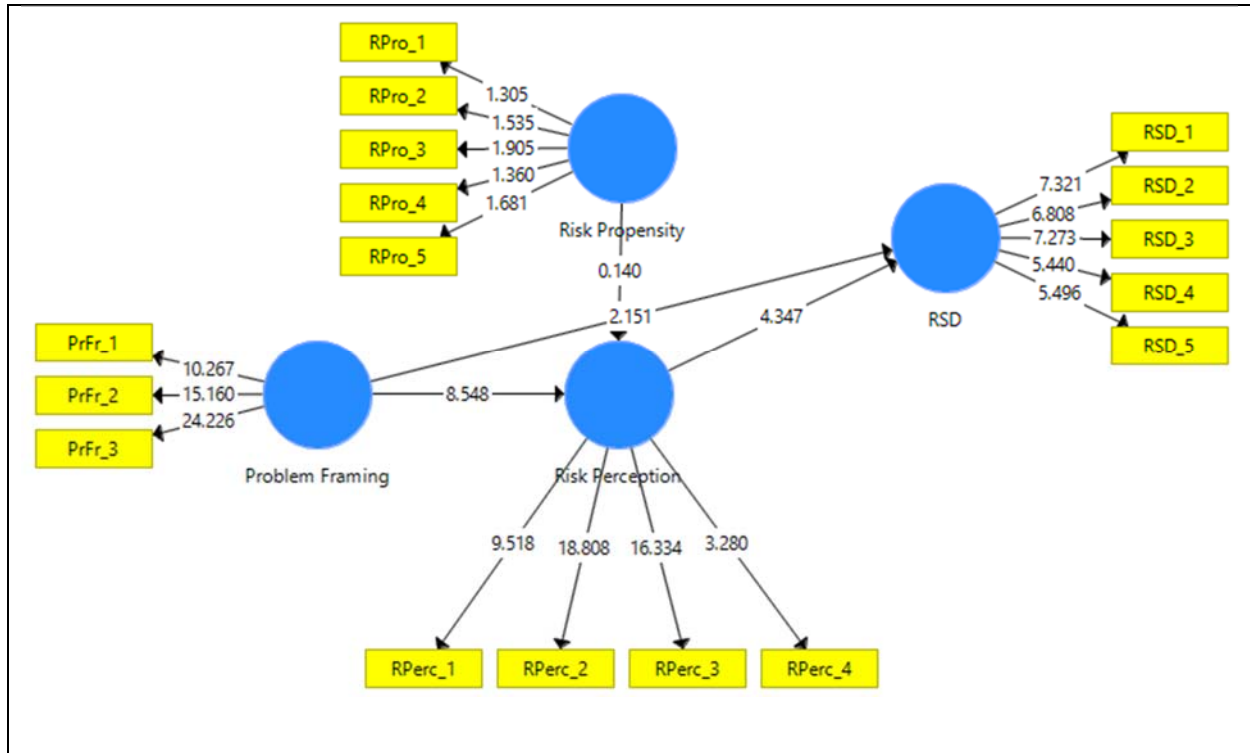


Figure 14: Predictive Validity - RSD

Table 23: Predictive Validity - RSD

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Problem Framing -> RSD	-0.269	-0.287	0.125	2.151	0.032
Problem Framing -> Risk Perception	0.596	0.596	0.070	8.548	0.000
Risk Perception -> RSD	0.532	0.561	0.122	4.347	0.000
Risk Propensity -> Risk Perception	-0.016	0.045	0.116	0.140	0.889

Testing the Structural Model

Testing H1, H2a, H3, H4a, H4b

To test our hypotheses in SmartPls 3.0, we used PLS Algorithm to calculate the weights and Bootstrapping to calculate the significance of the results, respectively. The bootstrap analysis was performed using 1000 subsamples. We first tested hypotheses H1a, H2a, H3, H4a, and H4b, as shown in Figure 15. The results of the analysis include significance level, path coefficients, and the variance explained. Moreover, we tested all our hypotheses with both categories of final decision (FD): 1) take medication and 2) not take medication. However, no significant difference were observed between these two categories.

As shown in Table 24, H1a, H4a, and H4b are supported at 0.05 significance level. However, H3 was not supported. Possible reasons for this finding will be provided in the conclusion section. Explained variance in CD, RSD, and FD, are 0.371, 0.296, and 0.045, respectively. Moreover, CD has a significant positive effect on RSD, which means that the more the cognitive dissonance, the more the degree of perceived decision making risk.

Table 24: Hypothesis Testing- H1a, H3, H4a, H4b

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics O/STDEV 	P Value	Hypothesis
CD -> RSD	0.380	0.379	0.030	12.553	0.000	
CD*NIC -> RSD	-0.074	-0.076	0.032	2.293	0.022	H4a S
CD*SeV -> RSD	-0.059	-0.060	0.025	2.331	0.020	H4b S
CD*SoV -> RSD	-0.008	0.002	0.051	0.158	0.875	H3 NS
Fit -> CD	-0.534	-0.535	0.025	20.970	0.000	H1a S
NIC -> RSD	-0.330	-0.332	0.031	10.774	0.000	
N_Preg -> FD	-0.055	-0.052	0.030	1.823	0.069	
RSD -> FD	0.130	0.130	0.033	3.964	0.000	
SEF -> FD	-0.147	-0.159	0.023	6.409	0.000	
SeV -> RSD	-0.164	-0.166	0.028	5.943	0.000	
SoV -> RSD	-0.197	-0.191	0.055	3.611	0.000	

S: Supported, **NS:** Not Supported

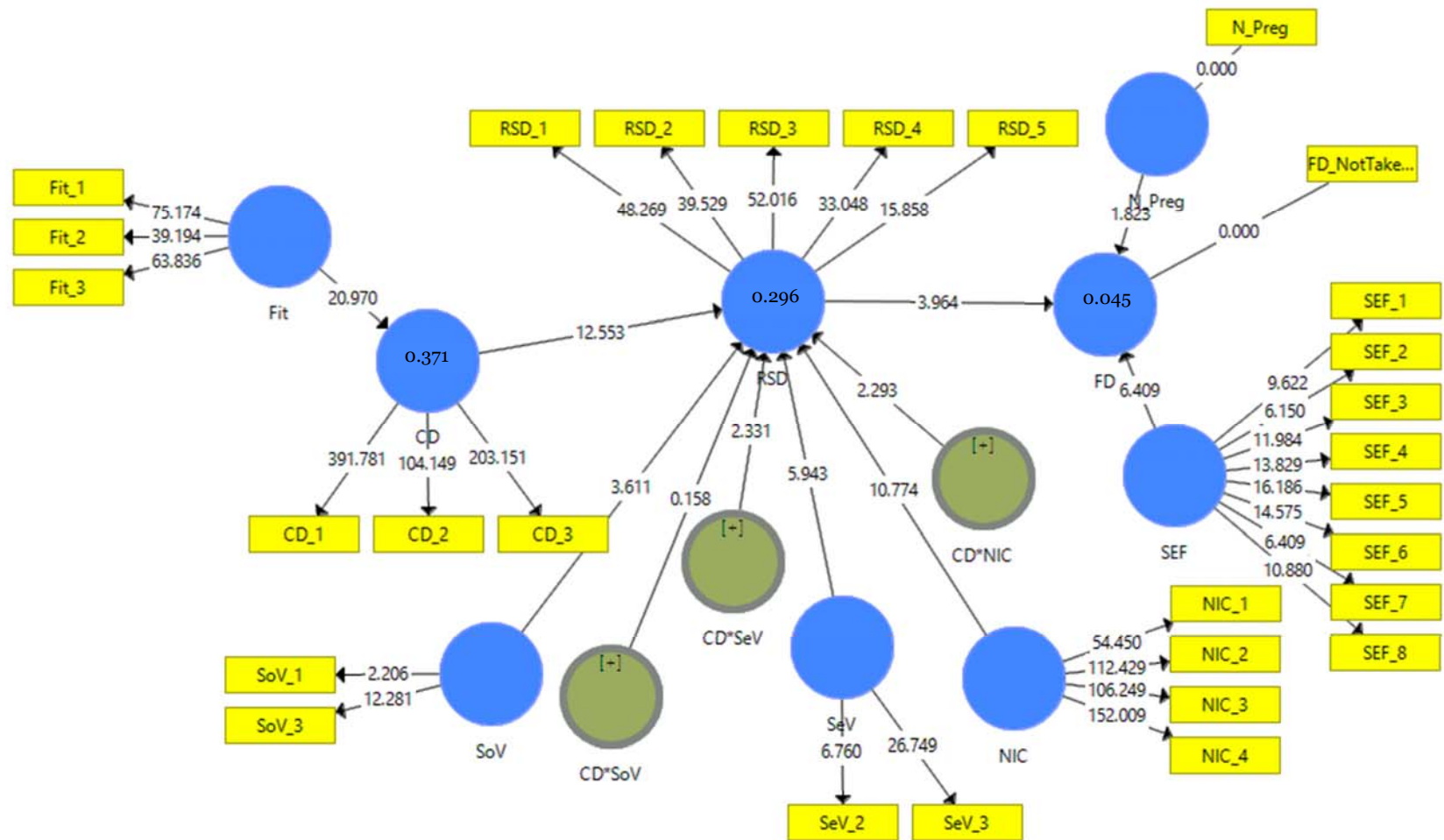


Figure 15: Hypothesis Testing Results

Testing H2a, H2b, H2c

To test H2 hypotheses, we used three sub-samples of our data. The first sub-sample contained opposite levels of MRIC and MROR (i.e. high/low or low/high). The second sub-sample contained low levels of MRIC and MROR, and the third sub-sample contained high levels of MRIR and MROR. Since we have used 7-point Likert scales, we considered anything below 4 as low and anything above 4 as high levels of MRIR and MROR. Although these sub-samples were smaller than our main sample (N=400), they were large enough to yield 0.80 power of the test (see the power calculation in “Sampling and Data Collection” section). Our sub-sample sizes were 173, 106, and 121 for H2a, H2b, and H2c, respectively. SmartPls 3.0 was used for hypothesis testing for each sub-sample.

Table 25: Hypothesis Testing - H2a, H2b, H2c

	MROR/ MRIC	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics O/STDEV	P Value	Hypot hesis
Fit -> CD	HL/LH	-0.656	-0.623	0.238	2.758	0.006	H1a (S)
CD -> RSD	HL/LH	0.490	0.378	0.186	2.639	0.008	H2a (S)
Fit -> CD	HH	-0.190	-0.194	0.066	2.870	0.004	H1a (S)
CD -> RSD	HH	0.392	0.391	0.055	7.159	0.000	H2b (NS)
Fit -> CD	LL	-0.476	-0.479	0.040	11.778	0.000	H1a (S)
CD -> RSD	LL	0.360	0.327	0.071	5.082	0.000	H2c (S)

(S): Supported, (NS): Not Supported, H: High, L: Low

As discussed earlier, when perceived medication risk from initial cognition (MRIC) and perceived medication risk from online reviews (MROR) are in different extremes of scale (i.e. high/low or low/high), the fit between MRIC and MROR is low. Thus, users experience more cognitive dissonance. This provides additional support for H1a. As shown in Table 25, when the fit between MROR and MRIC is low, the higher a user's cognitive dissonance, the higher the degree of decision making risk. This provides support for H2a. Moreover, when the degrees of MRIC and MROR are low, the lower a user's cognitive dissonance, the lower the degree of decision making risk. Therefore, H2c is supported. However, H2b is not supported. Possible reasons for this finding will be provided in the conclusion section. A summary of hypothesis results is provided in Table 26.

Table 26: Summary of Hypotheses Results

Hypothesis	Status
H1a: The lower the fit between the degrees of MRIC and MROR (high/low or low/high), the higher the degree of perceived cognitive dissonance.	Supported
H2a: When the fit between the degrees of MRIC and MROR (high/low or low/high) is low, the higher a user's cognitive dissonance, the higher the degree of decision making risk.	Supported
H2b: When both degrees of MRIC and MROR are high, the lower a user's cognitive dissonance, the higher the degree of decision making risk.	Not Supported
H2c: When both degrees of MRIC and MROR are low, the lower a user's cognitive dissonance, the lower the degree of decision making risk.	Supported
H3: The degree of social verification of the review negatively moderates the relationship between cognitive dissonance and risk-sensitive decision making.	Not Supported

H4a: The degree of new information confirming user's initial cognition negatively moderates the relationship between cognitive dissonance and risk-sensitive decision making.	Supported
H4b: The degree of self-verification of the reviewer negatively moderates the relationship between cognitive dissonance and risk-sensitive decision making.	Supported

Mediation Analysis

As shown in Figure 16 and Figure 17 , there are two mediating constructs. Cognitive dissonance (CD) mediates the relationship between Fit and risk-sensitive decision making (RSD). Also, risk-sensitive decision making mediates the relationship between cognitive dissonance and final decision (FD). We tested for the mediation effects by using Sobel test [300] to test for the significance of the direct relationship without the presence of the mediators. We then added the mediators to the model and checked whether the direct effects were statistically reduced or lost. As shown in Table 27, Sobel tests for mediation of RSD and CD are both significant (P value= 0.000<0.05). Moreover, RSD fully mediates the relationship between CD and FD because when RSD is added to the model, CD->FD is not significant anymore (P value= 0.312>0.05). Moreover, CD partially mediates the relationship between Fit and RSD because when CD is added to the model, while the effect of Fit on RSD is reduced to -0.156, Fit->RSD is still significant (P value = 0.000<0.05).

Table 27: Sobel Test for Mediation

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics O/STDEV 	P Values	Sobel Test	Two-tailed Probability
RSD Mediation						
CD -> FD	-0.032	0.032	1.012	0.312	3.704	0.000
CD -> RSD	0.380	0.031	12.072	0.000		
RSD -> FD	0.136	0.035	3.924	0.000		
CD Mediation						
Fit -> CD	-0.533	0.026	20.818	0.000	-7.0535	0.000
CD-> RSD	0.308	0.041	7.571	0.000		
Fit -> RSD	-0.156	0.041	3.774	0.000		

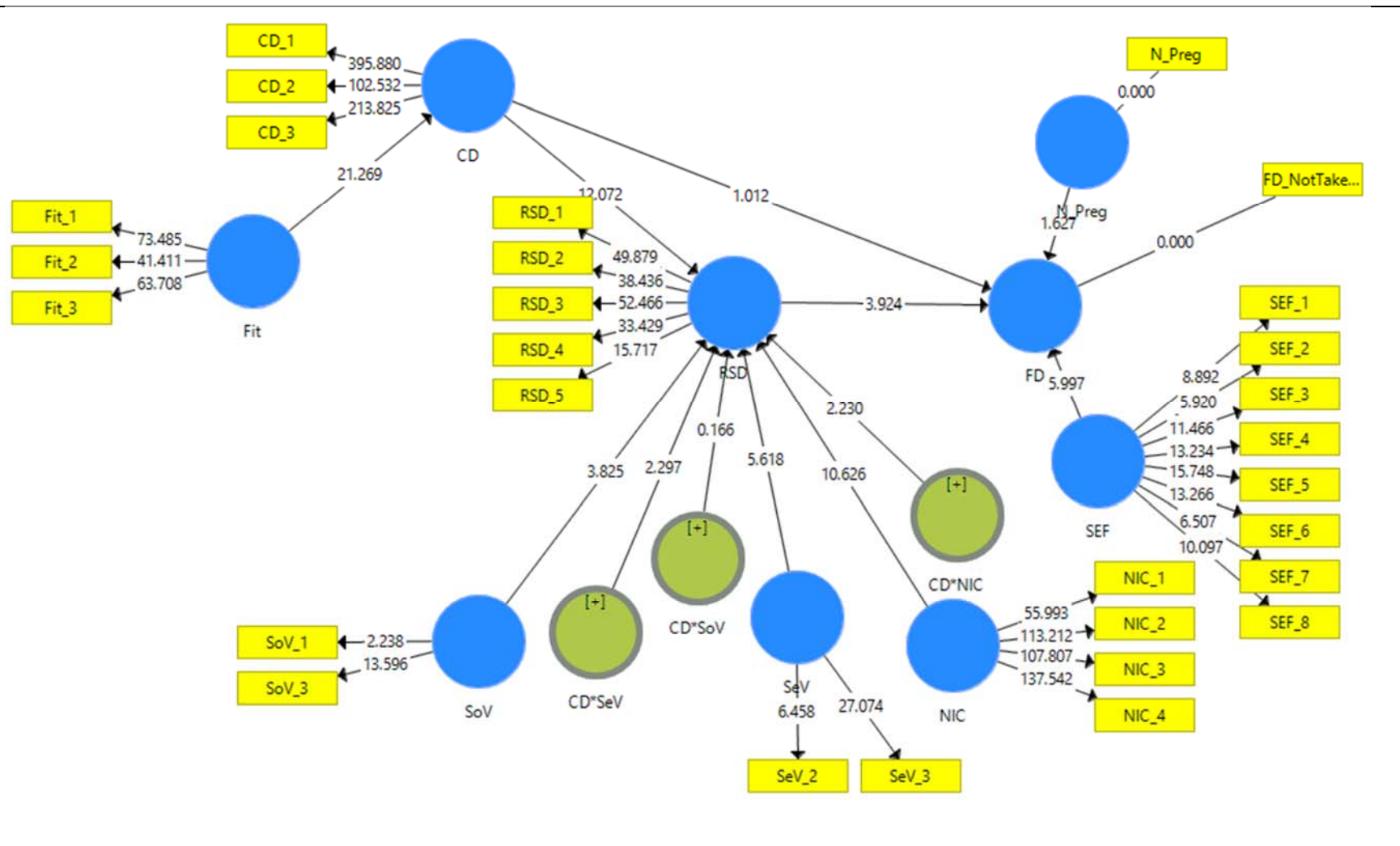


Figure 16: CD Mediation

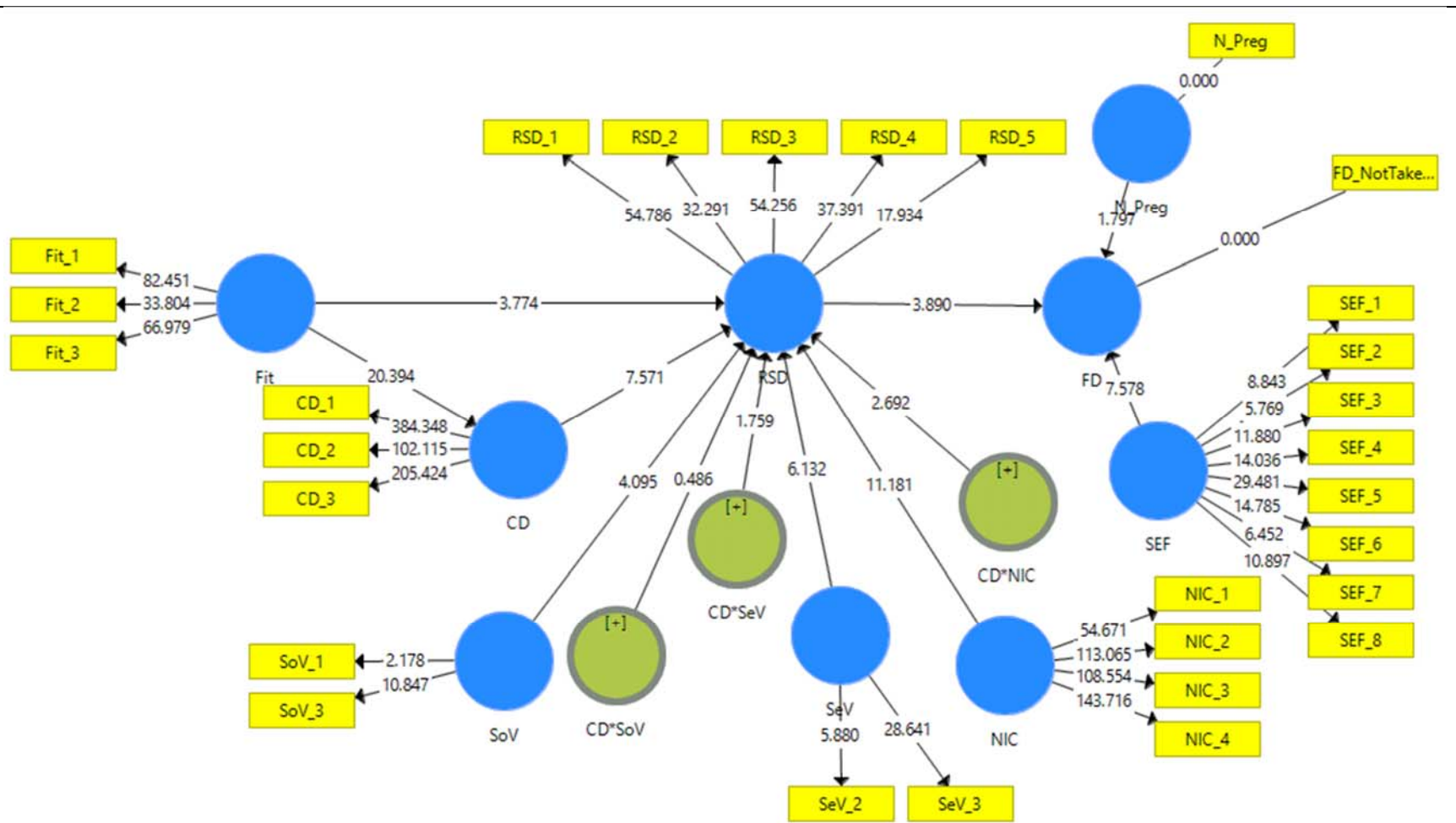


Figure 17: RSD Mediation

Conclusion and Discussion

Forming a novel stream of information systems (IS) research, the research on online communities has been often associated with new ways of interaction [76], unexpected organizational [301] and individual outcomes [204] such as increased social support [90], flexible forms of interactions [9], lower self-satisfaction [204], and worse decisions [302]. Given the increased use of online communities for collaboration purposes and the use of specialized communities (e.g. PatientsLikeMe), understanding their use and impact is arguably an issue of a particular importance to academics and practitioners alike.

In this work, we aimed to study the impact of online reviews on risk-sensitive decision making as users widely take advantage of online reviews to mitigate the risk in their decisions [9], obtain information on their conditions [75], and develop coping strategies when faced with uncertainties [303]. Online reviews are publicly available, readily accessible, associated with online profiles, and users are highly exposed to them [49]. Considering the specific design and the large scale of online reviews, selective exposure to information becomes more challenging for users. Thus, cognitive dissonance may be unavoidable in online communities where a mixture of information is shared in online reviews.

People use different sources including online reviews and expert advice to form initial cognitions and make decisions [62]. In particular, we argue that lower levels of fit between online reviews and individuals' initial cognition creates cognitive dissonance for them and results in making riskier decisions. The main contribution of this paper is to shed light on the mechanisms through which online reviews can impact risk-sensitive decision making, specifically when people form their initial cognitions using sources other than online

reviews. To our knowledge, most of the prior studies have assumed that people merely rely on online reviews to shape their initial cognitions [77]. However, when making important decisions, people also use other sources of information [78]. Thus, drawing on cognitive dissonance theory, we proposed a model with four main hypotheses to show how online reviews can create cognitive dissonance for users and how users can reduce their cognitive dissonance when making risk-sensitive decisions.

Our results show that except H2b and H3, all our hypotheses were supported by our data analysis. In H2b, we argued that when both degrees of MRIC and MROR are high, it shows that the overall risk of medication is high. Thus, although cognitive dissonance is low, the degree of decision making risk is still high. However, our results do not provide support for H2b. Based on our results, although MRIC and MROR show that the overall risk of medication is high, user does not experience cognitive dissonance and the degree of decision making risk will be low. One possible explanation for this result could be that the user may be strongly determined to change his/her health situation and although s/he knows that this medication has high risk, s/he does not perceive her decision as high risk.

Drawing on cognitive dissonance theory [13], we argued that users can reduce their cognitive dissonance by seeking social verification from others and reduce the degree of decision making risk (i.e. H3). However, this hypothesis was not supported. One possible reason for this result could be that social verification (i.e. social proof) may only have an impact, if the user can find similar others to validate her/his cognition. Since the user cannot estimate how similar other users who have provided social proof for the online review are, s/he cannot reduce her/his cognitive dissonance by looking at how many

people “liked” or found the online review helpful. All in all, our findings provided support for most of our hypothesis.

Chapter Five: Contributions and Future Research

Contributions

This thesis has focused on the use and impact of online communities in healthcare. We studied and compared how individuals use offline and online communities for peer support (Essay #1) and knowledge delivery (Essay #2), as well as how online communities impact individuals' decision making (Essay #3). The contributions of the three essays can be summarized as follows:

In essay #1, we contributed to the extant literature by providing an overview of peer support literature for breast cancer patients, comparing main peer support platforms, highlighting the main elements of peer support, identifying gaps, and providing future avenues for research. Moreover, we highlighted decision making support as a new type of peer support. In decision making support, individuals seek their peers' experiences regarding health decisions. Such support helps them to make decisions that are in line with their preferences, values, and needs. Decision making support enhances key communication skills on information seeking and question asking and is more prevalent in online communities.

We also contributed to the literature by showing that improved psychological health was the most prevalent health outcome when patients participated in peer support communities. Moreover, online communities have more impact on improving psychological health and awareness. However, offline communities are more effective in improving patients' coping ability and quality of life. Additionally, we showed that survey, randomized control trials, and qualitative methods were mainly used to study peer

support in both offline and online communities. However, literature is still sparse on social network analysis. Hence there is a need to develop this stream of research.

Essay #2 has two main contributions. First, we showed that specific technological configurations in offline and online communities influence knowledge delivery practices regarding vaccine administration. Second, we showed how the performative outcomes of material discursive practices could influence each other. We showed that shifting the focus from one material-discursive practice to many practices better explains how performative outcomes of one practice reconfigure local causal structures, boundaries, and properties of another practice.

We contribute to the literature by showing that offline knowledge delivery practices materialize in different ways including face-to-face interactions, written information during a physician visit, and information sessions. On the other hand, knowledge delivery practices in online communities materializes in shared text, multimedia messages, and news feed. Online communities are configured to allow personal opinions the same space as widely accepted scientific views. As a result of this materialization, the performative outcomes of knowledge delivery in online communities include spreading doubt in the safety of vaccines and increasing vaccine controversy views among people. Moreover, we created a timeline to show important events related to vaccine administration and the influence of pro and anti-vaccine views on each other since the invention of the first vaccine in 1796. For instance, as a response to the anti-vaccine movement in online communities government passed bill SB 277 and many scientific journals published extra educational materials supporting vaccine safety. Such enactments change the materializations in offline knowledge delivery practices.

In essay #3, we contributed to the literature by proposing a model to explain the role of online reviews in risk-sensitive decision making and in reducing cognitive dissonance for individuals. We also developed a scale to measure constructs in our model including cognitive dissonance, new information, and risk-sensitive decision. We addressed two issues in the extant literature. First, prior research has mainly considered the impact on online reviews on purchasing decision. However, in addition to online purchasing, online reviews have recently been used in different domains such as healthcare where users are faced with more risk-sensitive decisions. Risk-sensitive decision making has a different pattern than low risk decision because health decisions often include new and uncertain choices that can have a major impact on people's health. Our findings showed that online reviews can create cognitive dissonance and as a result increase the degree of decision making risk for individuals. Nonetheless, our results showed that users can reduce their cognitive dissonance by acquiring new information that confirms their initial cognition or by access addition information about the provider of online review (i.e. self-verification of the reviewer). Moreover, we replaced a common assumption in prior research. Instead of assuming that people merely rely on online reviews to form their initial cognitions and make decisions, we argued that people use multiple sources of information to shape their initial cognitions before using online reviews. This enables us not only to better explain the impact of online reviews on purchase decisions, but also on risk-sensitive ones.

Future Research

We have identified avenues for future research associated with each essay. First, to improve this research and bring it to the level required for submission to top-tier IS and

health informatics journals. Second, to pave the way to future research that will add to extant knowledge in the domain.

With regards to essay #1, building upon the insights that have emerged from our proposed framework, subsequent efforts will be focused on understanding informational and emotional needs of newly diagnosed patients. The results of our literature review on peer support communities showed that many studies focused on newly diagnosed patients. Therefore, it is important to understand their informational and emotional needs. Based on such understanding we can then develop necessary interventions in peer support communities to address informational and emotional needs of newly diagnosed patients.

In essay #2, we argued that performative outcomes of one material-discursive practices can have impact on one another. While our data analysis provided initial support for our propositions, a more comprehensive data analysis is required to provide further support for our propositions. Such data can include interviews with both healthcare professionals, pro and anti-vaccine individuals.

Essay #3 can also benefit from future research. Since our hypothesis regarding social verification of the review was not supported, additional research can aim at understanding the underlying cause of this issue. Two possible interaction effects can be further investigated. First, we can measure the degree of similarity between the user and the people who “liked” an online review. Second, we can measure the degree of user trust in online review [304] as it has been shown that trust is important in online communities where people rely on the socially acceptable behavior of others. It is possible that social verification of the review has an interaction with the degree of “similarity” and “trust”. As

such, by adding these two construct to the model, a more comprehensive understanding of cognitive dissonance in online communities can be achieved.

Conclusion

At the time in which individuals are increasingly using online communities to share information, provide support for one another, and reduce uncertainties in their decision making, it becomes critical to understand the implication of online communities for people. This thesis focused on this phenomenon by examining the use and impact of online communities on individuals. Our research showed how peer support and knowledge delivery practices are different in offline and online communities. Moreover, we showed that while online reviews can create cognitive dissonance for users, they can also help them overcome such dissonance and reduce uncertainties in their risk-sensitive decision making. Moreover choosing healthcare as the context of this thesis was a response to several calls for taking the industry more seriously into IS research [305]. As “industry provides an important contextual space to build new IS theory and to evaluate the boundaries of existing IS theory”, examining the use and impact of online communities in healthcare carries useful theoretical and practical implications, such as understanding the unique ways patients share information and provide support in online communities, and the impact of online communities on their decision making, to name but a few.

Appendix A: Screenshot of Coding Scheme

[illegible]

Figure 18: Coding Scheme - Part 1

[illegible]

Figure 19: Coding Scheme - Part 2

Appendix B: Measurement Instrument

Table 28: Measurement Instrument

Construct	Items
Risk-Sensitive Decision Making (RSD)	<p>Recall the last time you used <u>online reviews</u> during your pregnancy or breastfeeding period to get information about a <u>medication</u>. What was your final decision about this medication?</p> <ol style="list-style-type: none"> 1. I decided to take this medication 2. I decided not to take this medication
	<p>Recall the time when you were finally making your decision about this medication. Then, rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <ol style="list-style-type: none"> 1. My decision could have <u>uncertain</u> outcomes 2. My decision could have <u>diverse</u> outcomes 3. My decision could have <u>extreme</u> outcomes 4. My decision outcomes could be <u>disappointing</u> 5. I was unsure about the likelihood of my decision outcomes
Perceived Medication Risk from Initial Cognition (MRIC)	<p>Before reading online reviews, what was your initial understanding about this medication?</p> <p>Rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <ol style="list-style-type: none"> 1. Based on my initial understanding, I thought I would be harmed by this medication 2. Based on my initial understanding, I thought I was vulnerable to this medication 3. Based on my initial understanding, I thought the harm from this medication would be severe for me
Perceived Medication Risk from Online Review (MROR)	<p>What did you read in online reviews about this medication?</p> <p>Rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p>

	<ol style="list-style-type: none"> 1. According to online reviews, this medication was harmful for me 2. According to online reviews, I was vulnerable to this medication 3. According to online reviews, the harm from this medication was severe for me
Social Verification of the Review (SoV)	<p>Rate the following statements based on the online reviews that you read about this medication based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <ol style="list-style-type: none"> 1. Many people “liked” the online reviews 2. Many people found the online reviews “helpful” 3. Many people agreed with the online reviews
Self-Verification of the Reviewer (SeV)	<p>Rate the following statements based on the online reviews that you read about this medication based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <ol style="list-style-type: none"> 1. The provider of the online review shared her/his personal photos and videos 2. The provider of online review shared his/her personal information such as real name, nickname, address, age, interests, and relationship status 3. The provider of the online review shared information about her own pregnancy/breastfeeding experience
Cognitive Dissonance (CD)	<p>After reading online reviews, I realized that...</p> <p>Rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <ol style="list-style-type: none"> 1. My initial understanding about the harm of this medication was different than what was said in online reviews 2. My initial understanding about my vulnerability to this medication was different than what was said in online reviews 3. My initial understanding about the severity of this medication's harm was different than what was said in online reviews
New Information	Read the definition in the below table:


Confirming Initial Cognition (NIC)	Initial Understanding	Your information about this medication before reading online reviews.
	New Information	After you finished reading online reviews, if you kept searching and found new information about this medication, it means you had additional information.
	<p>Use the above table to rate the following statements about this medication based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <ol style="list-style-type: none"> 1. The new information that I found confirmed my initial understanding about this medication, in general 2. The new information that I found confirmed my initial understanding about this medication's harm 3. The new information that I found confirmed my initial understanding about my vulnerability to this medication 4. The new information that I found confirmed my initial understanding about the severity of this medication's harm 	
Control Variable: SEF	<p>Rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <ol style="list-style-type: none"> 1. I have been able to follow most of my medication instructions 2. When faced with difficult issues about my medications, I am sure that I can deal with them 3. In general, I think I can obtain medication results that are important to me 4. I believe I can follow my medication decisions 5. I believe I have been able to successfully decide about my medications 6. I am confident that I can follow different medication instructions 7. Compared to other people, I can follow most medication instructions very well 8. Even when things are tough, I can follow my medication decisions very well 	
Control Variable: Demographics	<p>Select your age range</p> <ol style="list-style-type: none"> 1. 18-29 years old 2. 30-39 years old 	

	<p>3. 40 years or older</p> <p>Select your highest level of education</p> <ol style="list-style-type: none"> 1. Less than high school degree 2. High school degree of equivalent 3. Some high school, but no degree 4. Bachelor degree 5. Graduate degree <p>Select the option that best describes you</p> <ol style="list-style-type: none"> 1. I am currently pregnant 2. I am currently breastfeeding 3. I was pregnant or breastfeeding less than two years ago 4. I was pregnant or breastfeeding more than two years ago 5. None of the above <p>If 1 is selected, then show: In which stage of the pregnancy are you now?</p> <ol style="list-style-type: none"> 1. 1 to 3 months pregnant 2. 3 to 6 months pregnant 3. 6 to 9 months pregnant <p>When are you due to give birth?</p> <ol style="list-style-type: none"> 1. In less than 3 months from now 2. In 3 to 6 months from now 3. In 6 to 9 months from now <p>How many times have you been pregnant in total?</p> <p>1 2 3 4 5 or more</p>
<p>Nomological Validity: Problem Framing</p>	<p>Rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <p>Having your decision about this medication in mind, how would you rate the following statements?</p> <ol style="list-style-type: none"> 1. Improving my health was key, even though I was uncertain about this medication 2. Taking this medication was the biggest opportunity I ever had to improve my health 3. I just had to take this medication—you can't win by sitting in the pits


Nomological Validity: Risk Propensity	<p>Rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <p>Having your decision about this medication in mind, how would you rate your tendency to the following statements?</p> <ol style="list-style-type: none"> 1. Choose more or less risky alternatives based on the assessment of others on whom you must rely 2. Choose more or less risky alternatives which rely upon complex analyses 3. Choose more or less risky alternatives which could have a major impact on your health 4. Initiate an action related to this medicine which had the potential to backfire 5. Support a decision when you were aware that relevant analyses were done while missing several pieces of information
Nomological Validity: Risk Perception	<p>Rate the following statements based on the following scale:</p> <p>To a very small extent, To a small extent, To some extent, Neither, To a moderate extent, To a great extent, To a very great extent</p> <p>How would you characterize your decision about this medication?</p> <ol style="list-style-type: none"> 1. Significant threat 2. Moderate threat 3. Low threat 4. Neither threat nor opportunity 5. Significant opportunity 6. Moderate opportunity 7. Low opportunity <p>What do you think about your medication decision?</p> <p>My decision had...</p> <ol style="list-style-type: none"> 1. Significant potential for loss 2. Moderate potential for loss 3. Low potential for loss 4. Neither loss or gain potential 5. Significant potential for gain 6. Moderate potential for gain 7. Low potential for gain <p>How would you characterize your decision about this medication?</p> <p>My decision was...</p>

	<ol style="list-style-type: none"> 1. Extremely positive situation 2. Positive situation 3. Somewhat positive situation 4. Neither positive nor negative situation 5. Extremely negative situation 6. Negative situation 7. Somewhat negative situation <p>What was the likelihood that your decision about this medication would be satisfactory?</p> <ol style="list-style-type: none"> 1. Very unlikely 2. Unlikely 3. Somewhat unlikely 4. Neither unlikely or likely 5. Very likely 6. Likely 7. Somewhat likely
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Appendix C: Card Sorting Analysis



BEYOND
BUSINESS
AS USUAL



Six categories are shown in the table below. Each question includes a sentence. To answer each question, you should select a category that best describes the sentence. One category can be selected in different questions.

Category	Definition
Initial Cognition	A person's primary knowledge or belief. For example, "At first, I thought this medication had no side effects".
Online Review Content	Information that is shared via online reviews. For example, "Based on online reviews, weight gain is a side effect of this medication".
Cognitive Dissonance	When a person realizes that what s/he believes in might actually be wrong. For example, a person initially believes that her/his medication has no side effects. But after reading online reviews, s/he realizes that the medication's side effect is weight gain. Therefore, s/he experiences cognitive dissonance. For example, "The side effects of this medication is not what I thought it would be".
Social Verification of the Review	When many people show they agree with the content of the online review. For example: Many people gave the online review a "thumbs up".
Self-verification of the Reviewer	Any personal information that the person who has written the online review shares with others, such as her/his nickname, address, photos, date of birth, etc.
New Information	Any additional information that you acquired about the medication from sources such as books, media, physicians, friends, etc.
Risk-Sensitive Decision Making	Making a sensitive and important decision. For example, "My decision to take this medication could have adverse impacts on my health".

If you have any comment about the below question, please first copy and paste the question; and then enter your comment in this box.

Based on my own primary understanding, I thought the harm from this medication would be severe for me

- ☐ Initial Cognition
- ☐ Online Review
- ☐ Cognitive Dissonance
- ☐ Social Verification of the Review
- ☐ Self-verification of the Reviewer
- ☐ Risk-Sensitive Decision Making
- ☐ New Information
- ☐ I don't know/Unrelated

0%100%

→

Figure 20: Screenshot of the Webpage for Card Sorting

The instructions for the card sorting analysis that was provided to participants in the three rounds of card sorting are shown in Figure 20 and Figure 19. In addition, Figure 20 illustrates a snapshot of the HTML page that was designed for sorting items in different categories. Table 29, Table 30, and Table 31 show a summary of the analysis results for the three rounds of card sorting that include the correct hits, the total placements (TTP), the hit ratio (hits divided by TTP), and actual total placements (ATP).

Table 29: Summary of the Card Sorting Analysis - Round 1

	Categories								TTP	Hits%
	1	2	3	4	5	6	7	8		
(1) Initial Cognition	18	5	7						30	60.00
(2) Online Review		18	10	1	1				30	60.00
(3) Cognitive Dissonance			21	6		2	1		30	70.00
(4) Social Verification of the Review		4	4	22					30	73.33
(5) Self-verification of the Reviewer		4		14	53	9			80	66.25
(6) Risk-Sensitive Decision Making	9		10			11			30	36.67
(7) New Information	4	4					32		40	80.00
(8) I don't know/Unrelated								0	0	0
Actual total placements (ATP) ¹⁴	31	66	52	43	54	22	33	0		
% Received ¹⁵	58.06	27.27	40.38	51.16	98.15	50.00	96.97	0		
Total Item Placements 270			Total Hits 175			Overall Hit Ratio 0.648				

¹⁴ ATP is the number of actual total placements made within a construct.

¹⁵ % Received = % correct item placements received by a category.

Table 30 : Summary of the Card Sorting Analysis - Round 2

	Categories								TTP	Hits%
	1	2	3	4	5	6	7	8		
(1) Initial Cognition	26	2	2						30	86.67
(2) Online Review	3	25				2			30	83.33
(3) Cognitive Dissonance	4		26						30	86.67
(4) Social Verification of the Review				30					30	100.00
(5) Self-verification of the Reviewer		3			27				30	90.00
(6) Risk-Sensitive Decision Making	2	2	3		3	48	2		60	80.00
(7) New Information	2					3	35		40	87.50
(8) I don't know/Unrelated								0	0	0.00
Actual total placements (ATP)	37	69	31	30	30	53	37	0		
% Received	70.27	36.23	83.87	100.00	90.00	90.57	94.59	0		
Total Item Placements 250		Total Hits 217				Overall Hit Ratio 0.868				

Table 31: Summary of the Card Sorting Analysis - Round 3

	Categories								TTP	Hits%
	1	2	3	4	5	6	7	8		
(1) Initial Cognition	30								30	100.00
(2) Online Review		30							30	100.00
(3) Cognitive Dissonance		1	27		2				30	90.00
(4) Social Verification of the Review		2		28					30	93.33
(5) Self-verification of the Reviewer		2			27		1		30	90.00
(6) Risk-Sensitive Decision Making	3		2			45			50	90.00
(7) New Information	3	1	1				35		40	87.50
(8) I don't know/Unrelated								0	0	
Actual total placements (ATP)	36	72	30	28	29	45	36	0		
% Received	83.33	41.67	90.00	100.00	93.10	100	0	0		
Total Item Placements 240		Total Hits 222				Overall Hit Ratio 0.925				

Appendix D: Recruitment Notice

Hello,

We are conducting a research study into the role of online reviews in individuals' decision making. Specifically, our intent is to explore, if individuals change their decisions about the medication after accessing online reviews. This study is conducted by Professor Liette Lapointe and Ms. Ghazaleh Aghili Dehkordi (graduate student) at McGill University. The study consists of an online survey that takes about 10 minutes to complete. The survey is anonymous. You are invited to participate in this research study. This study has received an ethics approval from McGill University.

To be eligible to participate, you must be at least 18 years of age, currently pregnant or have been breastfeeding within the past two years, and used online reviews to obtain information about taking a medication during your pregnancy or breastfeeding period. You will receive compensation of \$1 for your participation in this survey.

If you choose to participate, you can access further information and provide consent at the survey.

Your responses will be kept confidential and will not be shared with anyone else.

If you have any concerns or questions, please feel free to contact us at any time.

Professor Liette Lapointe liette.lapointe@mcgill.ca	Ghazaleh Aghili Dehkordi ghazaleh.aghilidehkordi@mail.mcgill.ca
Desautels Faculty of Management, McGill University 1001 Sherbrooke Street West, Montreal QC, Canada H3A	

Appendix E: Consent Form

About This survey

This survey was developed as part of a PhD. thesis at McGill University, Montreal, Canada. This survey has been approved by the McGill's Research Ethics Board. If you decide to be in this study, you will be asked to answer some questions about your most recent experience with online reviews during your pregnancy or breastfeeding period. The full survey will take about 20 minutes to fill. Participation in this study is voluntary. You can also quit at any time. However, no question can be skipped.

Purpose of the Research

The objective of this research is to understand how online reviews impact user risk-sensitive decision making. This study does not involve any manipulation of variables or intervention by the researchers.

Compensation

You will receive compensation of \$1 USD for your participation in this survey. Please note that there are certain requirements that you must meet to be eligible for participation as well as receiving compensation. You might not be eligible for participation and/or receiving compensation due to any of the following reasons: 1) You do not agree to participate, 2) You do not qualify to participate in this study. This will be identified through some screening questions that ask about participants demographic or background questions, 3) You fail to properly answer a question that check to see if you read and understand the instructions.

Privacy and Confidentiality

Your participation is fully anonymous. Your participation in this survey is fully anonymous. All data collected during this study will be stored in a personal computer which is secured with passwords. To anonymize respondents, numbers will be used as identifiers in database, instead of names. The anonymized results of this study may be used in a PhD thesis, news articles and press releases, academic journals or conference proceedings. Participation in this survey is voluntary. However, no question can be skipped. Only the researchers and their research assistants will have access to this study's data. If you have any questions or concerns regarding your rights or welfare as a participant in this research study, please contact the McGill Ethics Officer at +1-514-398-6831.

Disclaimer

The pictures in this survey were used from the following websites: <https://rategain.com/blog/tips-improve-online-reviews-hotel/>; <https://www.makeuseof.com/tag/ignore-five-kinds-online-reviews/>; <https://willbecoded.ca/build-truthful-reviews-online/>; <https://www.texaseviction.com/blog/5-tips-for-managing-online-apartment-reviews/>; <https://www.cdc.gov/vaccines/pregnancy/index.html>; <https://www.sanovadermatology.com/skin-care/three-acne-medicines-that-are-safe-to-use-during-pregnancy/>; <http://freepngdownload.com/thinking-women/thinking-woman-png-free-download-3/>; <https://www.flickr.com/photos/philwolff/4582276033/>; <http://www.picpedia.org/highway-signs/d/decision-making.html>.

Researchers' Contact Information

If you have any question about this research, you may contact Ghazaleh Aghili Dehkordi at ghazaleh.aghilidehkordi@mail.mcgill.ca, or Dr. Liette Lapointe at liette.lapointe@mcgill.ca. If you agree to participate in this survey, please check the below box.

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