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Unusual purchasing behavior during the early stages of the COVID-19 pandemic: The stimulus-organism-response approach

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ABSTRACT

During the COVID-19 pandemic, unusual consumer behavior, such as hoarding toilet paper, was reported globally. We investigated this behavior when fears of consumer market disruptions started circulating, to capture human behavior in this unique situation. Based on the stimulus-organism-response (S-O-R) framework, we propose a structural model connecting exposure to online information sources (environmental stimuli) to two behavioral responses: unusual purchases and voluntary self-isolation. To test the proposed model, we collected data from 211 Finnish respondents via an online survey, and carried out analysis using PLS-SEM. We found a strong link between self-intention to self-isolate and intention to make unusual purchases, providing empirical evidence that the reported consumer behavior was directly linked to anticipated time spent in self-isolation. The results further revealed exposure to online information sources led to increased information overload and cyberchondria. Information overload was also a strong predictor of cyberchondria. Perceived severity of the situation and cyberchondria had significant impacts on people's intention to make unusual purchases and voluntarily self-isolate. Future research is needed to confirm the long-term effects of the pandemic on consumer and retail services.

1. Introduction

Unusual retail consumer behavior, such as hoarding toilet paper and food, was reported all over the world during March 2020 when the COVID-19 virus escalated into a pandemic (Miri et al., 2020; Wang et al., 2020). The presumed cause was not only the looming health threat of COVID-19 and possible risk of being quarantined, but also fears of the disease causing factories to halt production and a global disruption of supply chains. Retail and consumer services suffered from this unusual situation in several ways. The initial rush for certain items caused shelves to empty, while a surplus was created for others. Google's (2020) COVID-19 community mobility report showed that access to retail and recreational services decreased considerably all over the world due to the pandemic after March 2020. The changes in consumer behavior impacted not only grocery stores, convenient stores, cafeterias, and restaurants but also their suppliers. It is important for at least three reasons for retail and consumer services to understand the underlying processes and reasons that led to the reported unusual behavior: first, to be able to better react to similar situations in the future; second, to help the currently suffering retail and consumer services to deal with the ongoing COVID-19 pandemic; and third, to provide knowledge for an optimal transition to the new status quo of consumer and retail services that is expected to emerge once the COVID-19 pandemic is curbed.

Previous research on behavior during outbreaks and pandemics linked behavioral change as an outcome of individual-level motivations and government-enforced policies (Wen et al., 2005). Individual- and government-level decision making is prone to errors and biases in new and unclear situations (Weinstein, 1988). The greater the novelty, unpredictability, and ambiguity, the safer the actions individuals take (Brug et al., 2009). Thus, information sources have played a major role in consumer behavior during the COVID-19 pandemic (Laato et al., 2020). Accordingly, the aim of this study is to understand the role of information in consumer behavior during unprecedented situations on a global scale that contain a looming threat of halted factory production

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and disrupted supply chains. In doing so, we address the following gaps in previous work. First, although studies have been conducted on local catastrophes and epidemics, a pandemic of the magnitude and economic impact of COVID-19 has not been seen in a century. These studies focused primarily on individuals' protection motivation and health measures (Gamma et al., 2017; Rubin et al., 2009; Seale et al., 2009; Timpka et al., 2014) rather than consumer behavior. Furthermore, previous literature did not examine exhaustively how online information sources affect behavioral change during a pandemic. The context of the COVID-19 pandemic allows us to investigate how people behave during a serious global pandemic when information concerning it is being broadcast through various online media.

For addressing the research gaps above, we adapted the stimulus-organism-response (S-O-R) framework (Mehrabian and Russell, 1974) and propose two dependent variables: unusual purchasing and voluntary self-isolation. We used the S-O-R framework to investigate how the environmental stimuli of online information sources on COVID-19 ultimately led to these behaviors. We tested the model with data collected from university employees and students in Finland during March 2020. The COVID-19 pandemic was escalating in several European countries, and information regarding it was bombarded to consumers through all news channels and social media.

The rest of the paper is structured as follows. First, we review the existing literature on human behavior during unusual global circumstances such as pandemics. Next, we present the research context and related theories. We then use the theories to build hypotheses and a research model, after which we report our data collection methods and results. We conclude this work with practical and theoretical implications, limitations, and future work.

2. Background

2.1. Pandemics and behavioral change

There have been several epidemic outbreaks in recent world history, for example, Ebola, SARS, MERS, swine flu, and dengue fever (Balinska and Rizzo, 2009). Most prominently, the outbreaks have had an impact on two categories of human behavior: consumer behavior (Miri et al., 2020) and health risk mitigation behavior (La Torre, 2019). In addition, severe macroeconomic implications typically follow in areas hit by a pandemic causing unemployment, uncertainty, and an economic recession.

One model used in pandemic literature to explain behavior is the RANAS model. This model was developed to systematically understand health-related behavior by taking risks, attitudes, norms, abilities, and self-regulation into consideration (Mosler, 2012). The model has been applied to understand behavior during pandemics. Social norms, perceived severity, response beliefs, and health knowledge predict adoption of individual prevention measures (Gamma et al., 2017, 2020). In addition to the health measures mentioned, outbreaks and pandemics are expected to have a significant impact on consumer behavior. Scholars have reported increases in purchasing of food, face masks, hand sanitizer, and other items perceived to be important for surviving the pandemic (Goodwin et al., 2019). In addition to RANAS, the protection-motivation theory (PMT) has been employed for understanding the underlying motives of human action during epidemic situations (Farooq et al., 2020; Laato et al., 2020a; Sharifirad et al., 2014; Timpka et al., 2014). The findings of work using PMT emphasized the impact of an individual's threat and coping appraisal on behavioral intentions (Timpka et al., 2014), which calls for research on the factors influencing these appraisals.

Selected literature on the impact of epidemics on human behavior is summarized in Table 1. Previous researchers focused heavily on preventive health behavior, and consumer behavior has received less attention. Furthermore, the theoretical foundations of the studies have been limited, making it difficult to generalize and expand the findings to other contexts. Finally, as the COVID-19 pandemic situation is unprecedented and unique, it allows us to gain insight into human behavior during a global pandemic event of massive scale where individuals have considerable uncertainty about how to act with no clear point of reference. For taking the consumer side into account, one successful and robust framework is the S-O-R (Sherman et al., 1997). We propose that combining the viewpoint of S-O-R with existing theoretical lenses typically used to understand human behavior during pandemics, such as PMT (Rogers, 1975), would offer insight into how environmental stimuli related to the pandemic leads to unusual purchasing.

2.2. The COVID-19 pandemic and the public response

By 2007, more than 36 coronaviruses were known, and among them, SARS coronavirus (SARS-CoV) was the most researched, with more 4000 studies conducted on it (Cheng et al., 2007). Researchers found horseshoe bats are a natural source of SARS-CoV, whereas civets act as the intermediary amplification host. Cheng et al. (2007) argued that the

Table 1
The literature on pandemics and human behavior.

Authors(s)	Country	Epidemic	Sample	Theory	Selected findings
Gamma et al. (2020)	Gambia	Ebola	498	RANAS model	Critical psychological factors influence the adoption of avoidance measures. Beliefs and social norms were identified as the two most important factors.
Gamma et al. (2017)	Guinea-Bissau	Ebola	1369	RANAS model	Perceived severity and health knowledge are predictors for adopting prevention behaviors. Campaigns propagating health knowledge had less impact than expected.
Laato et al. (2020a)	Finland	COVID-19	855	Protection-motivation theory, self-determination theory	Individuals' acceptance of government measures for curbing the pandemic and perceived severity of the pandemic correlate with adoption of recommended health behaviors.
Rubin et al. (2009)	United Kingdom	Swine-flu (Influenza A H1N1)	997	No theory specified or explicitly mentioned	Few people changed their behavior during the early stage of the swine flu epidemic. Perceived severity increased action, while lack of trust in officials and self-efficacy lowered it.
Goodwin et al. (2009)	Malaysia	Swine-flu (Influenza A H1N1)	328	No theory specified or explicitly mentioned	Response to swine flu was seen at the population level with reduced travel and increased purchasing of face masks and food.
Seale et al. (2009)	Australia	Swine-flu (Influenza A H1N1)	620	No theory specified or explicitly mentioned	Quarantine and vaccines are perceived as better countermeasures than personal hygienic measures.
Timpka et al. (2014)	Sweden	None specified	443	Protection-motivation theory	The individual coping appraisal is a significant factor in influencing prevention behavior such as self-isolation.
Sharifirad et al. (2014)	Iran	Swine-flu (Influenza A H1N1)	300	Protection-motivation theory	Protection motivation leads to adoption of avoidance behavior. However, perceived severity was not related to protection motivation.

tendency to keep these animals near each other is a time bomb, and the reemergence of a coronavirus is inevitable. However, it took roughly 18 years from the emergence of SARS until the current coronavirus SARS-CoV-2 causing a respiratory disease called COVID-19 was detected and started to spread among humans.

In December 2019, the new coronavirus SARS-CoV-2 causing the COVID-19 disease that involves mild to severe respiratory symptoms surfaced in Wuhan, China (Xu et al., 2020). Although COVID-19 is an acute resolved disease, it can be lethal, with current death rate estimates ranging from 0.4% to 3% of those infected (Xu et al., 2020). Compared to the previous coronavirus-caused disease SARS, COVID-19 has a significantly greater reproductive number (Liu et al., 2020). Its capability to spread rapidly and infect led to a global outbreak in early 2020, which escalated to the World Health Organization (WHO) declaring COVID-19 a global pandemic on March 11, 2020. SARS, a previous infectious coronavirus disease, caused 8098 reported human infections and 774 deaths in 32 countries during the years it was active (McAleer, 2020). In contrast, as of March 27, there were 465,915 confirmed COVID-19 cases in 199 different countries or territories, with 21,031 direct deaths caused by the virus. On May 16, there were 4.3 million confirmed cases and more than 79,000 deaths (WHO, 2020). In addition to the origin country China, massive outbreaks have been reported, for example, in the United States, Italy, Iran, Spain, France, and Germany (WHO, 2020).

Governments, stock markets, and consumers reacted quickly to the virus. Almost all countries hit by the virus issued restrictions on movement, placing people in quarantine, closing public services such as schools, canceling and banning large public gatherings, etc. (Anderson et al., 2020; Farooq et al., 2020). These actions radically altered the status quo of society, even in countries and areas where the COVID-19 pandemic was not yet acute, as governments took proactive measures to minimize the anticipated damage (Stoecklin, 2020). The country in which we collected data from at the time had fewer than 1000 confirmed cases of COVID-19. However, news and information about the virus were freely and widely available, and the government had issued movement and social meeting restrictions to combat the disease. Thus, this study focused on a country impacted by fear of COVID-19 and related disruptions, causing proactive measures to emerge on government and individual levels.

2.3. Theoretical foundation

In this study, we employed the S-O-R framework as an overarching theory, as previous researchers demonstrated its predictive power in how retail consumers react to novel environmental stimuli (Gao and Bai, 2014; Mehrabian and Russell, 1974; Vieira, 2013; Xu et al., 2014). Furthermore, we used theoretical reasoning from PMT (Rogers, 1975) and cognitive load theory (CLT; Sweller, 2011) to establish causality between relevant constructs.

Marketing researchers have used the S-O-R framework to understand environmental factors (Xu et al., 2014). The framework is based on work by Mehrabian and Russell (1974), who conceptualized behavior as occurring in an environment, which consists of *stimuli*. The stimuli affect the *organism*, more specifically, consumers' cognitive and affective processes, which then leads to a behavioral *response*. This three-part conceptualization has enabled the formulation of models in which instead of direct causal links between stimuli and action, affective and cognitive intermediate layers are included (Xu et al., 2014). In the context of a global pandemic, we suggest that the stimuli should be the information sources from which individuals learn about the pandemic. As the widespread use of online news sources makes COVID-19 unique among previous pandemics, we focused on online information sources. To link the organism aspect of S-O-R to the chosen stimuli, we focused on information overload (Dhir et al., 2018, 2019; Malik et al., 2020; Whelan et al., 2020a), which we propose causes psychological and behavioral responses.

The aspect of environmental response in S-O-R regarding information overload can be understood through CLT, which deals with how the human brain processes new information (Sweller, 2011). CLT is based on the presumption that humans have limited cognitive capacity. The situation when this capacity is exceeded is called cognitive overload, and it invokes a stress response in humans to take a step backward to a safer, less demanding situation. Accordingly, researchers have used CLT to explain a wide variety of phenomena that require cognitive processing and conceptualization of situations; for example, why people suffer from information and communication overload (Dhir et al., 2018, 2019; Malik et al., 2020; Whelan et al., 2020a). The quality of the news, information, and communication regarding COVID-19 plays an important role in individuals' decision making and behavior (Laato et al., 2020). CLT postulates that if the cognitive capacity to process the information is overloaded, then the behavioral response (of the organism) can be adversely affected (Sweller, 2011), contributing to the possibility of irrational action. An individual's previous knowledge, thinking skills, and self-efficacy have moderating effects on the behavioral response (Attiq et al., 2017). Although the environment ultimately pushes organisms toward certain reactions, individual and group characteristics may act as an opposing or amplifying force.

In addition to CLT, we use PMT to support the S-O-R framework, which explains the factors affecting motivation to take steps against imminent health threats (Rogers, 1975). The theory suggests that motivation to adopt protective measures, such as self-isolation, is a result of personal threat and coping appraisal. Threat appraisal typically constitutes perceived severity and susceptibility. Perceived severity refers to the seriousness of the overall situation, as the name implies. Perceived susceptibility or vulnerability refers to how likely individuals perceive themselves to be at risk. The coping appraisal is the personal estimate of an individual's ability to cope with the situation (Brug et al., 2009). It is typically seen to constitute self-efficacy, response efficacy, and response costs. This means that scholars have often used self-efficacy literature in PMT research to understand the effect of threat and coping appraisal on the adoption of protective health measures (Maddux and Rogers, 1983). Accordingly, PMT has been employed in different contexts to understand users' motivation, for example, health-related behaviors (Milne et al., 2000) and pro-environmental behavior (Kothe et al., 2019), among others.

For the research model, we adopted the perceived severity and self-efficacy constructs from PMT to capture individuals' threat and coping appraisal during COVID-19. We adopted information overload from CLT to capture the cognitive load that the abundance of available COVID-19 information causes individuals. As we looked at the effects of online information sources on behavior, we also adopted the cyberchondria construct (Jokić-Begić et al., 2019) to describe the health anxiety that may arise from COVID-19. Using the S-O-R framework (Mehrabian and Russell, 1974), we placed online exposure to online information sources as the environmental stimuli, information overload as the organism, and two psychological responses (cyberchondria and perceived severity) and two behavioral responses (intention to make unusual purchases and intention to self-isolate) as responses.

3. Research model and hypotheses

3.1. Impacts of exposure to online information sources

Currently, society is filled with news being broadcast through various media, including radio, the internet, traditional newspapers, emails, and social media, among others. The role of internet sources has steadily increased in recent years, and is one reason that differentiates COVID-19 from previous pandemics (Abd-Alrazaq et al., 2020; Farooq et al., 2020). *Exposure to online information sources* refers to the number of online sources through which people receive information. Making sense of the vast amount of information from multiple sources is not straightforward, as conflicting, unclear, and even fake news circulate

constantly on the internet (Laato et al., 2020; Talwar et al., 2019, 2020). During unprecedented and unusual events, such as the COVID-19 pandemic, the novelty of the situation does not allow relying extensively on existing cognitive knowledge structures, which can increase the amount of circulating fake news (Ahmed et al., 2020; Laato et al., 2020).

CLT states that people have limited cognitive capacity to process information. Once the amount of information that has to be processed crosses the limit of an individual's processing capability, information overload occurs (Dhir et al., 2018, 2019; Malik et al., 2020; Whelan et al., 2020a). The information processing capability of an individual in a given situation is the result of their previous knowledge and processing skills, their affective state, currently experienced intrinsic, extraneous, and germane cognitive loads, as well as the communication and presentation of the new information (Sweller, 2011). Previous studies have empirically verified the impact of the communication platform by demonstrating that information and system characteristics increase individuals' information loads (Lee et al., 2016). Following the findings of these studies, we postulate that once an individual receives too much (and often conflicting and misleading) information regarding COVID-19, they become overwhelmed and subsequently, experience information overload. Thus, information overload is the result of receiving a large quantity of (novel) information within a limited time interval that exceeds the individual's current working memory processing capabilities (Sweller, 2011; Whelan et al., 2020a). Thus, we hypothesize the following:

H1. Exposure to online information sources positively influences information overload.

Another aspect related to exposure to online information sources during a pandemic that poses a serious health threat is cyberchondria (Laato et al., 2020). Cyberchondria refers to a situation when an individual is overly stressed or anxious about their health, which leads to excessive, compulsive, and repeated health-related online searches that fuel anxiety, distress, and fear (Starcevic and Berle, 2013). Due to the availability of many electronic information sources, it is easy for an individual to search for and read information about a particular issue, such as in the current case, COVID-19, and related symptoms (Jokić-Begić et al., 2019). As the amount of available information is enormous, exhaustive acquisition of it all is not possible. Furthermore, the information is not always accurate, or it can be incomprehensive or ambiguous, which can cause distress in people and ultimately, develop into cyberchondria (Jokić-Begić et al., 2019; Vismara et al., 2020). Researchers have found the clarity, comprehensiveness, and medical accuracy of newly acquired health information is a crucial countermeasure for proactively mitigating cyberchondria (Aiken et al., 2012). However, during a pandemic situation such as COVID-19, it can be difficult for individuals to organize all online information clearly and accurately (Balinska and Rizzo, 2009). Furthermore, the media companies and others creating COVID-19 news online might be in a hurry to publish stories. As information is unclearly available even for news creators, this rush increases the presence of inaccurate information, which can further increase cyberchondria (Laato et al., 2020). Therefore, we postulate the second hypothesis:

H2. Exposure to online information sources positively influences cyberchondria.

Perceived severity is the extent to which one believes that a threat (for example, a disease) is serious (Floyd et al., 2000). It also reflects how serious contracting the disease would be on individual and group levels. Perceived severity is one of the main constructs in popular theoretical models (such as the PMT) that affect risk perceptions and creates motivation to take precautionary measures against a disease (Rogers, 1975). Previous work showed that perceived severity significantly predicts intention to take measures against life-threatening diseases, such as acute health issues (Ruthig, 2016) and pandemics (Bults et al., 2015). For behavioral change to occur, humans must perceive they have a sufficient reason to change. However, researchers have found that a strong behavior intention has only a small to medium impact on behavior change (Webb and Sheeran, 2006).

In the case of COVID-19, serious predictions regarding the disease emerged online in March 2020. Reports appeared about governments preparing quarantine measures, restricting movement, and closing borders. News also emerged of factories halting production and global supply chains being disrupted, which gave birth to fears of food and supply shortages (Maital et al., 2020). The many information sources, among them social media where factors such as social influence (Kelman, 1958) are at play, conveyed the situation to people. If seemingly different communication channels communicate the same news, this can boost people's perception of the relevance of the information. Accordingly, we theorize that the greater the number of information sources communicating the severity of the situation, the more severe the resulting individual perception of the situation. Thus, we hypothesize the following:

H3. Exposure to online information sources positively influences perceived severity.

3.2. Impacts of information overload

Information overload is a state of cognitive overload (Sweller, 2011) that triggers a stress response in humans to retreat. Without the ability to handle available information and conceptualize what is going on, humans are unable to behave and respond optimally (Brug et al., 2009; Weinstein, 1988). The lack of cognitive capacity to process available information forces people to guess the severity of the situation. Previous studies have shown that in these situations humans are likely to make pessimistic guesses to be safe (Lupien and Lepage, 2001). Accordingly, experiencing information overload in a pandemic situation such as COVID-19 can increase perceived severity. Humans are unable to conceptualize the situation and determine the possible dangers, and whether they can be avoided. Thus, we hypothesize the following:

H4. Information overload increases perceived severity.

Cyberchondria is a situation of distress, anxiety, and a compulsive need to seek medical information on a topic fueled by an existing concern (Starcevic and Berle, 2013). In normal circumstances, the majority of online searches for health information do not relate to cyberchondria but to specific symptoms people have and for which they seek an explanation (Morahan-Martin, 2004). Users are likely to avoid commercialized sites when searching for health information. However, users have been found to have poor capability to evaluate the credibility of the information they read (Morahan-Martin, 2004). As the internet is filled with all kinds of information, cyberchondriac behavior increases the risk of running into articles claiming untruthful things. Especially during pandemics and novel situations, there exists the risk of individuals finding sensational news that lacks journalistic rigor (Laato et al., 2020). Reading conflicting news may invoke the urge to find proof for the claims. When there is an abundance of ill-structured news and even misinformation, and no consensus on what is going on, the information overload may pose an increased risk to individuals that their online searching escalates into cyberchondria. Thus, we postulate the following hypothesis:

H5. Information overload increases cyberchondria.

3.3. Impacts of perceived severity

As the COVID-19 disease is transmitted through proximal contact with other people, isolation measures were identified as the most important preventative measure (Farooq et al., 2020). These measures can be classified into four categories: (1) isolation, (2) quarantine, (3) social distancing, and (4) community containment (Wilder-Smith and Freedman, 2020). Isolation refers to individual-level removal from

social contact. Quarantines can occur at individual or group level and refer to the behavior of avoiding social contact or movement for a certain period. Social distancing is used to describe a more radical measure, such as closing schools or libraries to minimize the number of social contacts people have (Wilder-Smith and Freedman, 2020). However, the term social distancing has also been adopted to refer simply as maintaining distance from others in face-to-face social meetings. As the scientific definition is different (Wilder-Smith and Freedman, 2020), this might confuse some readers. Community containment refers to the full lockdown of a specified area and is beyond individual control. Community containment is usually government-sanctioned and enforced by law.

In this paper, when discussing intention to self-isolate, we refer to the voluntary reduction of social contacts, maintaining distance in social gatherings, and avoiding visits to restaurants, public transportation, cafeterias, and other crowded places. Adopting this kind of behavior can be painful for socially active individuals, while for others, it might be more natural. When discussing adopting personal avoidance measures during a global pandemic, how close and severely humans perceive the situation to be has been theorized to impact intention to self-isolate (Sharifirad et al., 2014). PMT suggests that a stronger individual threat appraisal leads directly to taking protective measures (Rogers, 1975). Furthermore, previous studies empirically verified that perceived severity leads to the adoption of protective health measures (Gamma et al., 2017; Rubin et al., 2009). Accordingly, we postulate the following hypothesis:

H6. Perceived severity positively influences intention to self-isolate.

According to the S-O-R framework, consumer behavior is the result of environmental stimuli, the affective and cognitive states of an individual, and their response to these states (Xu et al., 2014). Typically, consumer behavior change occurs when environmental stimuli change. Too radical and fast environmental change can overload the cognitive ability to handle the situation, which leads to a more emotion-influenced response. This can result in panic buying (Leung et al., 2020). It is defined as a strong urge to go and buy products, often in excess of what would be reasonable (Shou et al., 2013), or simply a milder change in consumer behavior we refer to as unusual purchasing.

During the COVID-19 pandemic, panic buying and its milder form, unusual purchasing, were observed. For example, in several countries, grocery stores and convenience stores ran out of toilet paper, hand sanitizer, and canned food products (Miri et al., 2020). One reason given is that previous coronaviruses, such as SARS, caused diarrhea, nausea, vomiting, and abdominal discomfort (Miri et al., 2020), which arguably caused people to prepare for this. Other factors included social pressure (people feared they would be left without necessary products unless they purchased them immediately), and that there, ultimately, is little harm in purchasing products that last for an extended period of time and are needed in any case (e.g., toilet paper). Goodwin et al. (2009) found that people's food purchases increased due to the swine flu outbreak. Furthermore, a previous meta-analysis identified concerns that arise (such as that for the environment) are a major influence on consumer behavior (Joshi and Rahman, 2015). Thus, it follows that in the case of the COVID-19 pandemic, its perceived severity can have an impact on the urgency felt to react by purchasing materials and preparing for quarantine or other circumstances where regular living is not possible. Thus, we postulate the following:

H7. Perceived severity increases the intention to make unusual purchases.

3.4. Impacts of cyberchondria

A recent literature review of cyberchondria associated the condition with health anxiety, obsessive compulsive disorder, and problematic internet use (Vismara et al., 2020). However, the main behavior associated with cyberchondria is excessive online searches for health information Jokić-Begić et al. (2019); Starcevic and Berle (2013). Extending this literature, we propose that cyberchondria during pandemics can drive other behaviors. Through excessive online searching cyberchondriacs compared to others find more information regarding the pandemic situation. This behavior increases cognitive load in the short run. However, in the long run, it can lead to a better-than-average understanding of the topic. This is highly dependent on the information sources available and the cyberchondriac's capability to process and understand the information. Accordingly, in March 2020 when the COVID-19 pandemic was still growing, and the situation was unclear and novel, cyberchondriacs may have caught wind of it earlier than others, as they were anxious about their health and searching online for more information. As official sources suggested voluntary self-isolation as an effective countermeasure to curb the pandemic (Farooq et al., 2020), cyberchondria may have played a role in people's actions. Furthermore, as online sources communicated about an upcoming health disaster, cyberchondriacs may have felt an urge to prepare by making unusual purchases. Therefore, we propose the following two hypotheses:

H8. Cyberchondria increases intention to self-isolate.

H9. Cyberchondria increases intention to make unusual purchases.

3.5. Impacts of self-efficacy

Self-efficacy is one's perception of one's ability to control events that affect one's life (Bandura, 2010). This belief is paramount for emotional well-being. Unless individuals believe they can transform their surroundings with their actions, they have no emotional or cognitive reason to do anything (Bandura, 2010). Thus, self-efficacy is generally seen as almost exclusively positive, enabling action and pushing through struggles. For example, self-efficacy positively correlates with job satisfaction (Federici and Skaalvik, 2012). However, as human beings are not omniscient, self-efficacy should also have limits and be based on reality. As a construct, self-efficacy is a prominent part of individuals' coping appraisal in PMT along with response efficacy and response costs. Previous studies observing human behavior during pandemics found self-efficacy correlates positively with increased protection motivation and the adoption of preventive behaviors (Farooq et al., 2020; Sharifirad et al., 2014).

Scholars have adapted self-efficacy and divided it further, for example, into computer self-efficacy, professional self-efficacy, and multitasking self-efficacy (Islam et al., 2018), among others depending on the context of the study. We investigated two behavioral intentions: self-isolation and unusual purchases. Thus, in line with these two behavioral intentions, we decompose self-efficacy into isolation self-efficacy and purchasing self-efficacy. We define isolation self-efficacy as the belief in being able to control and influence the physical proximity of the self to others and being able to socially distance at one's own will. Similarly, we define purchasing self-efficacy as the belief in being able to make purchases at will despite the unusual circumstances. In the context of the COVID-19 pandemic, we suggest that purchasing self-efficacy translates into not feeling the need to make extraordinary purchases, as the individual will remain functional and capable of making purchases whenever needed. Self-isolation self-efficacy, however, seems linked to response cost because of the specific behavior it measures in this context. The belief in being able to self-isolate at will suggests that individuals do not see response costs in adopting the recommended health behavior. Thus, we propose an asymmetrical impact of self-efficacy on the two measured dependent variables:

H10. Isolation self-efficacy increases intention to self-isolate.

H11. Purchasing self-efficacy reduces intention to make unusual purchases.

3.6. Impact of self-isolation

As the final relation in the model, we examine the connection between intention to engage in voluntary self-isolation and intention to make unusual purchases. We base our theorizing on the presumption that consumer behavior is tied to other behaviors. During the COVID-19 pandemic, independent of personal health perceptions people had a good reason to anticipate that they might be forced into quarantine for some period of time as governments were issuing various restrictions for curbing the pandemic (Parmet and Sinha, 2020). Furthermore, as official sources such as WHO recommended people engage in voluntary self-isolation (Farooq et al., 2020), people had reasons to prepare for such action. We predict that a significant proportion of the observed unusual purchasing was done to prepare for isolation. This could have been further increased by social influence (Kelman, 1958), as well as fears of global disruptions in supply chains. The observed consumer behavior in the early stages of the COVID-19 pandemic indicated that people brought items related to health protection (hand sanitizer) but also in preparation for disrupted supply chains and forced to spend prolonged periods at home (toilet paper and canned food). Accordingly, we propose that the individual-level behavioral responses during COVID-19 are linked, in that intention to self-isolate increases intention to make unusual purchases. Thus, we propose a final hypothesis:

H12. Intention to self-isolate increases intention to make unusual purchases.

The research model connecting all the hypotheses is displayed in Fig. 1. The model has eight constructs and 12 research hypotheses.

4. Empirical study

4.1. Study context

To test the model, we collected data from university students and employees in Finland through a web survey. The survey was available for one week from March 19 to 25, 2020. Typically, cross-sectional studies can be online for longer for data collection purposes. However, due to the rapidly changing nature of the COVID-19 pandemic, we decided to narrow down the data collection to one week. As of March 29, Finland had 1218 verified cases of COVID-19 out of roughly 18,000 who had been tested for the disease (Terveyden ja hyvinvoinnin liitto, 2020). This means that roughly at the time of data collection, only 0.02% of the country's population had contracted the disease. The majority of the cases were in the area called Uusimaa surrounding Finland's capital, Helsinki. On March 27, 2020, the Finnish government placed Uusimaa in lockdown restricting movement in and out of the region. Before that, on March 18, the Finnish government closed all public schools, libraries, and universities, forcing them to adopt distance learning solutions. Simultaneously, all meetings of 10 or more people were canceled and banned, and visits to elderly homes were restricted. Citizens older than 70 years old were strongly advised to stay indoors, and all citizens were advised to adapt self-isolation measures. In addition, other minor recommendations and restrictions were put in place. As March 18 marked the date for the majority of the restrictions, we chose the day after as a suitable time to deploy a survey regarding behavioral intentions during the pandemic.

4.2. Survey design and data collection

We designed the questionnaire mostly by adapting validated scales from previous literature to the present research context. We modeled exposure to online information sources as a formative construct because we expected that the measurement items might not correlate with each other. We modeled the other constructs as reflective. After we had drafted the questionnaire, we asked 11 respondents to go through the survey items and provide feedback on the wording. Based on the feedback, we made some minor changes. The final survey questionnaire and the sources of the scales are shown in Appendix 1. In addition, we included in the survey text explaining and clarifying for the respondents

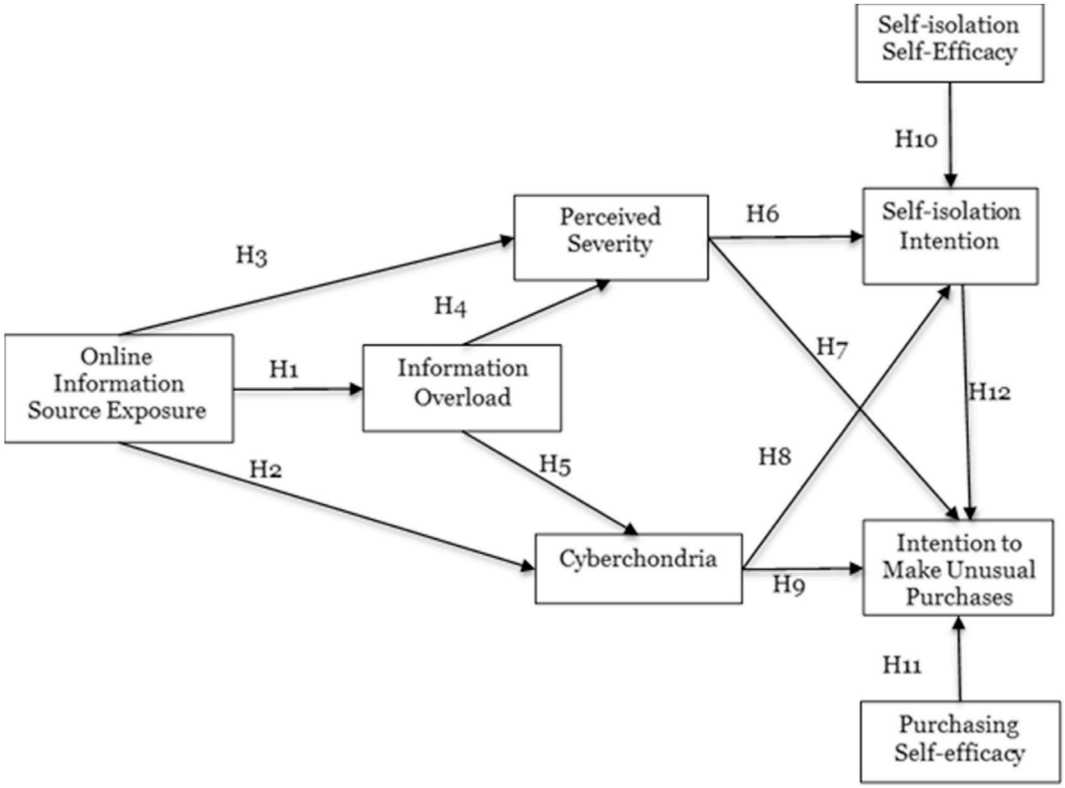

Fig. 1. The proposed research model.

what we meant regarding some of the concepts we used. For example, before we asked about avoidant measures, we included the following elaboration: "The following avoidant measures have been suggested to avoid contracting the coronavirus (COVID-19): 1. Cancel or postpone social events 2. Reduce going to crowded places (e.g., public transportation, shops, restaurants). Now, keeping in mind the measures above, select the options among the statements given below that best describe you." Before we asked about unusual purchasing, we included the following: "Some of the following extraordinary purchase behaviors have been evident in the area of pandemic in the past: 1. purchasing extra hygienic products-face masks and hand wash/sanitizers for protection 2. Stocking up on food and/or other necessities. Now, please read each of the following statements and select the option that best describes your opinion regarding unusual purchasing."

We distributed the survey link in a university online newsletter in Finland. The survey statistics showed that link was opened by 227 respondents, of whom 211 responded to all questions and gave permission to participate in the research. The survey platform took measures to prevent participants from answering the survey twice. We did not have any missing data, as all the questions were mandatory to answer. Furthermore, when we examined the data, we did not find any careless responses (e.g., the same answer to all questions). Therefore, we did not delete any responses, and we used all 211 responses to test the research model. Approximately 63% of the respondents were female. Forty percent of respondents were younger than 25 years, 33% were between 26 and 34 years, 14% were between 35 and 44 years, 8% were between 45 and 54 years, and the others (5%) were older than 55 years. Regarding the respondents' status at the university, 65% were students, 31% were academics, and the others were general staff. When asked about education level, 15% reported they had a college degree, 49% had completed a bachelor's degree, 31% had completed a master's degree, and the remaining 5% had a doctoral degree.

5. Data analysis and results

Before evaluating the structural model, we ensured the validity and reliability of the data. To this end, we used the SmartPLS tool. Among alternatives for testing a structural model, PLS is widely popular and widely used due to its capability in combining linear regression with confirmatory factor analysis. PLS is also reliable for detecting actual paths and not detecting non-existent paths in covariance-based structural equation modeling (Goodhue et al., 2012). Barclay et al. (1995) argued that for testing structural models with PLS, the sample size should be at least 10 times larger than the number of independent variables in the model. As the present model had six independent variables (intention to make unusual purchases), this criterion was fulfilled.

To ensure the validity and reliability of the data, we first tested the convergent validity of the data using the Fornell and Larcker (1981) criteria. Accordingly, we tested (1) the loadings of individual items, (2) composite reliabilities (CRs) of each construct, and (3) their average variance extracted (AVE) value. Following the Fornell and Larcker (1981) criteria, the loadings of the individual items must be at least 0.7 for the data to be considered valid. The analysis showed one purchasing self-efficacy item, one cyberchondria item, and one perceived severity item did not meet this criterion. Therefore, we removed these items from the respective scales. For CRs, the recommended threshold is 0.8 (Fornell and Larcker, 1981). The results in Appendix 1 show that the data meet this criterion. The AVEs must be at least 0.5, which we also verified for the collected data (see Appendix 1). Thus, we concluded that the data had sufficient levels of convergent validity among the reflective constructs. Finally, we looked at the weights of the individual items in the formative constructs. We observed that three items (university email, university intranet, and government website) did not have statistically significant weights on the information exposure construct. Therefore, we removed these items.

Next, we observed the discriminant validity of the data. We did this in two steps. First, we examined the correlation matrix presented in Table 2 with the square roots of the AVEs presented diagonally. The table shows that the square roots of the AVEs are consistently higher than the off-diagonal correlation values. Second, we examined the loadings and cross-loadings presented in Appendix 2. We observed that the loadings were much higher than the cross-loadings. The two approaches together ensured that the data had sufficient levels of discriminant validity.

As a final test, we checked for common method variance (CMV) in the data. We followed two approaches to test for CMV. First, we performed a popular single-factor test. We observed that no single factor explained the substantial portion of the total variance in the data. Then, we performed a common method factor test. We observed that the method variance was very small in comparison to the substantive variance (the ratio was 52:1). The small method variance indicated that CMV was not a major concern in the data.

After ensuring sufficient validity and reliability of the data, we tested the proposed research model. Fig. 2 shows the results. Exposure to online information sources (beta = 0.35, $p < 0.001$) had a statistically significant effect on information overload; therefore, H1 was supported. H2 was also supported as exposure to online information sources had a statistically significant effect on cyberchondria (beta = 0.18, $p < 0.01$). H3 was not supported. Exposure to online information sources did not have a statistically significant effect on perceived severity. Information overload did not have a statistically significant effect on perceived severity; therefore, H4 was not supported. Information overload (beta = 0.57, $p < 0.001$) had a positive effect on cyberchondria; thus, H5 was supported. H6 was supported; perceived severity (beta = 0.18, $p < 0.01$) had a statistically significant positive impact on intention to self-isolate. We observed that perceived severity (beta = 0.16, $p < 0.05$) also had a statistically significant positive impact on intention to make unusual purchases. Therefore, H7 was supported. Cyberchondria (beta = 0.13, $p < 0.05$) had a positive impact on intention to self-isolate. Thus, H8 was supported. Cyberchondria also had a positive impact on intention to make unusual purchases (beta = 0.16, $p < 0.05$); therefore, H9 was supported. H10 was supported; self-isolation self-efficacy (beta = 0.40, $p < 0.001$) had a statistically significant effect on intention to self-isolate. In contrast, H11 was not supported. Purchasing self-efficacy did not have a statistically significant effect on intention to make unusual purchases. Finally, H12 was supported; intention to self-isolate (beta = 0.33, $p < 0.001$) had a direct effect on intention to make unusual purchases.

6. Discussion

6.1. Key findings

The structural model results showed a clear relation between intention to self-isolate and intention to make unusual purchases. This result empirically showed that the unusual purchasing behavior observed in March 2020 globally was linked to quarantine preparations. Cyberchondria and perceived severity had similar effects on the two measured behavioral responses. Thus, although the two behaviors (unusual purchasing and voluntary self-isolation) are clearly distinct from one another, both were strictly related to COVID-19, and were predicted by the same factors.

In addition, we would like to emphasize two surprising findings. First, in contrast to our theorizing, neither exposure to online information sources nor information overload had a statistically significant effect on how severely individuals perceived the pandemic situation. However, both increased cyberchondria, which is a state of health anxiety. The way we measured perceived severity (see Appendix A) was information-based. Thus, it is possible that people experiencing information overload due to being exposed to too many sources of information about COVID-19 were unable to process and conceptualize what was going on, which hindered their ability to perceive the actual severity

Table 2
Correlation matrix and the square roots of the AVEs.

	Intention to self-isolate	CyberChondria	Information Overload	Online Information Source	Perceived Severity	Intention to make unusual purchases	Purchase Self-Efficacy	Self-isolation Self-Efficacy
Intention to self-isolate	0.75							
CyberChondria	0.18	0.78						
Information Overload	-0.02	0.62	0.82					
Online Information Source	0.016	0.37	0.34	1.00				
Perceived Severity	0.25	0.39	0.07	0.00	0.72			
Intention to make unusual purchases	0.36	0.29	0.11	0.17	0.29	0.78		
Purchase Self-Efficacy	-0.10	-0.17	-0.22	-0.04	-0.03	-0.04	0.85	
Self-isolation Self-Efficacy	0.40	-0.04	-0.19	-0.13	0.01	0.07	0.04	0.77

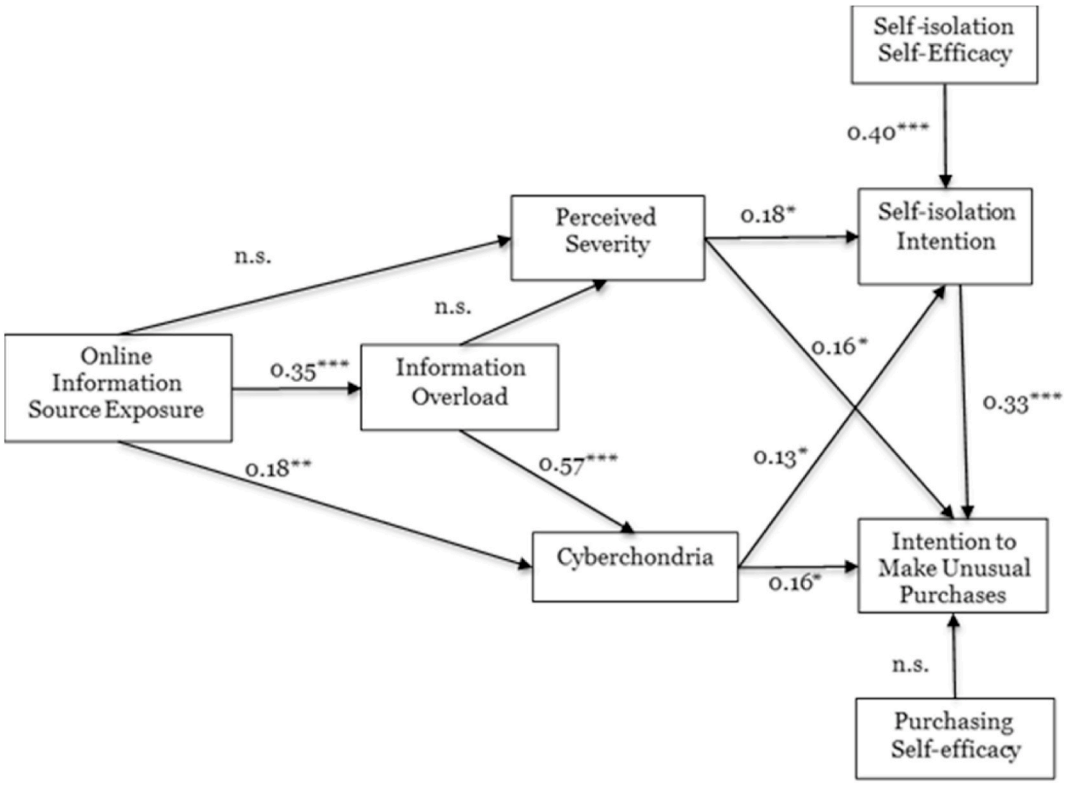

Fig. 2. Structural model results. (***p < 0.001. **p < 0.01. *p < 0.05.)

of the situation. Regardless, through cyberchondria, exposure to online information sources and information overload had an impact on intention to self-isolate and intention to make unusual purchases.

Second, when examining the effects of self-efficacy, we noticed that one dimension (self-isolation self-efficacy) had a statistically significant positive influence on intention to self-isolate. The other measured dimension (purchasing self-efficacy) had no impact on making unusual purchases. This asymmetrical role of self-efficacy highlights the benefit of decomposing self-efficacy in relation to behaviors to get a fine-grained understanding of its impacts in specific contexts. Self-efficacy is about an individual's level of belief of being able to carry out a given behavior. Thus, people with higher self-efficacy are able to maintain control of the situation and refrain from performing unusual behavior. Isolation is a rational and recommended form of behavior in the case of contagious diseases like COVID-19. Therefore, it makes sense that self-efficacy positively influences intention to self-isolate. In contrast, high purchasing self-efficacy was linked to the belief that the individual is capable of making purchases at will regardless of possible quarantine measures or global food supply chain disruptions. Thus, high purchasing self-efficacy also carried the belief that there was no need to make unusual purchases. However, we found self-efficacy still played a role in unusual purchasing via the measured significant relation between intention to make unusual purchases and intention to self-isolate.

6.2. *Theoretical implications*

We present four theoretical implications for these results. First, in contrast to previous literature that investigated the role of demographics, information, and system characteristics in predicting information overload (Whelan et al., 2020a), we empirically showed how exposure to multiple information sources leads to information overload. Therefore, this study extends existing research (Whelan et al., 2020a, 2020b) that investigated various factors that affect information overload. Furthermore, according to our knowledge, this is the first study that investigated how multiple sources of information can ultimately lead to information overload in a pandemic such as COVID-19.

Second, the study results emphasize that exposure to various information sources leads to cyberchondria. Previous researchers mostly investigated the associations between cyberchondria and individual factors, such as self-esteem and anxiety sensitivity (see Jokić-Begić et al., 2019; Vismara et al., 2020). We expanded on previous research by showing that exposure to online information sources and information overload increased cyberchondria in the COVID-19 context. As a large aspect of cyberchondria is reading through information from multiple sources, this empirically found correlation is not surprising. The results provide further evidence that cyberchondria is an escalating disease. Exposure to online information sources leads to cyberchondria, which leads to behavior that further increases exposure to online information sources (Jokić-Begić et al., 2019; Starcevic and Berle, 2013; Vismara et al., 2020). Therefore, we add to this body of literature by identifying exposure to online information sources as a predictor of cyberchondria, particularly in the context of a global pandemic. We further showed that cyberchondria, ultimately, leads to behavioral responses such as intention to self-isolate and intention to make unusual purchases.

Third, we investigated the effects of self-efficacy by decomposing it to self-isolation self-efficacy and purchasing self-efficacy. This decomposed approach provided a fine-grained understanding of the impact of self-efficacy on consumer behavior. The results showed the impacts of the two self-efficacy variables were asymmetrical. Accordingly, these results expand PMT research (Bish et al., 2011; Farooq et al., 2020) during pandemics and other research drawing on self-efficacy by supporting the idea of contextualizing self-efficacy to specific behaviors (Ling et al., 2019).

Finally, previous researchers used S-O-R to explain user behavior in various contexts (see Xu et al., 2014), but to the best of our knowledge, not in the context of pandemics. When we adopted S-O-R in the present context, we employed information sources as stimuli, information overload as the organism, cyberchondria and perceived severity as psychological responses, and intentions to self-isolate and make unusual purchases as behavioral responses. We confirmed most of the hypothesized relations. Thus, we conclude that S-O-R is a robust framework that can explain consumer behavior in the context of a pandemic such as COVID-19.

6.3. Practical implications

Government bodies issued strict limitations on citizen movement as measures to contain and suppress the spread of COVID-19 (Anderson et al., 2020). However, much attention was also given to informing and educating the population about the global situation with COVID-19, stressing the importance of washing hands and keeping social distance as individual preventative measures. The present results support previous work on outbreaks (Gamma et al., 2017) by showing that perceived severity is directly linked to adoption of these measures. This implies that to a certain degree, it is useful to emphasize the seriousness of the situation to people. However, perceived severity was also linked to intention to make unusual purchases. This is not surprising as people intending to voluntarily self-isolate also need to make unusual purchases to support that way of living. This indicates that consumer and retail services can anticipate unusual consumer behavior during pandemics, or any situation for that matter, by observing what other kinds of behaviors individuals plan to take.

As the S-O-R framework suggests, individuals react to environmental stimuli at cognitive and affective levels. Individual moderation of the affective influence is needed for rational decision making. This can be difficult in ill-defined, ambiguous, and unclear circumstances, such as the time of the data collection period in March 2020 when the COVID-19 virus was spreading rapidly in Europe. Governments took varying measures to counter it, and the internet and social media were filled with all kinds of information regarding the events. As we noticed exposure to online information sources correlates with cyberchondria, individuals should avoid excessive information seeking and stick to a few reliable, high-quality sources.

Although retail sales increased during the early stages of the COVID-19 pandemic, restaurants, cafeterias, and other foodservice businesses suffered greatly from government-enforced limitations on their operations and individuals' decisions to stay home (Bartik et al., 2020). Furthermore, Google Trends showed a global overall decrease of roughly 30% in the use of retail and recreational services (Google, 2020). This decrease in consumer activity combined with the change in consumer activity forced not only consumer and retail services but also suppliers to quickly adapt their business to the new status quo. Examples include restaurants and grocery stores focusing more on online sales and take-away deliveries, a paint factory in Finland starting to produce hand sanitizer, and consumer goods retailers increasingly disinfecting their stores. Perceived severity, cyberchondria, and intention to self-isolate increased intention to make unusual purchases. Thus, consumers stocked up on foods and other items for long periods. The unusual purchasing may have been profitable for grocery stores not only in the short term. As people were spending more time at home and eating out less, they likely had to buy more food than usual from grocery stores. The potential benefits of this transition of business from restaurants to grocery stores may have been diminished to a degree. However, as people bought groceries less frequently, they were also less likely to make impulse purchases. Finally, in addition to retail and consumer markets, understanding what drives this kind of consumer behavioral change is important in marketing literature (Watne and Brennan, 2011) and physical health interventions (Oinas-Kukkonen, 2013), among other fields. For example, as we saw people engaged in voluntary self-isolation, this may have increased time spent stationary and thus, lead to diseases associated with a sedentary lifestyle.

6.4. Limitations and future research

The collected data were cross-sectional, and described the situation in a country that was less impacted by active COVID-19 cases. However, information regarding the disease was ubiquitously offered through various online and news channels. In addition, the government prepared for the situation by closing schools, restaurants, and public services, which may have sparked fears of upcoming disruptions and triggered behavioral responses in people. Furthermore, we surveyed university employees and students, who might be considered to be more capable than average to conceptualize and react to new knowledge. These limitations should be considered when interpreting the results. We believe these results provide insights into unusual consumer behavior and panic buying during the few weeks following the WHO's declaration of the COVID-19 pandemic. However, to strengthen the scientific understanding of the phenomenon, we encourage future researchers to take opportunities to study panic buying whenever a real-world empirical data collection opportunity emerges. In addition, although the items for unusual purchase provided sufficient internal consistency and validity in the context of COVID-19, we urge future researchers to adapt the items in their context with caution. We merged items regarding hygiene product purchases and food purchases together as they fit the context of the study in the unique situation. However, encourage future researchers to keep them separate.

After the data collection period for the present study ended, consumers quickly adapted to the new normal of COVID-19. As the results were dependent on time, longitudinal studies on the topic could be interesting. For example, the information overload construct might have less impact over time, as individuals have time to familiarize themselves with the new situation and be less impacted by affective responses and more by cognition. Furthermore, the survey responses were self-reported data. Thus, real-world empirical observations and data from retailers and consumer services could be used to support these findings. In addition, there exists at least 19 scientific frameworks focusing specifically on behavior change (Michie et al., 2011). We carefully selected the theories we used and deemed them suitable for explaining pandemic

behavior and consequently, addressing the identified gaps in previous literature. However, other behavioral change theories might offer new insights.

An avenue of future research could be extending the research model by including social influence. Kelman's (1958) social influence theory postulates humans are likely to change their behavior and accept influence from their perceived social in-group. In the S-O-R framework, social influence can be regarded as amplifying or dampening the effects of the cognitive and affective states on the behavioral response (Bastian et al., 2012; Neal and Chartrand, 2011). For example, if an individual notices that all their family and friends are hoarding a specific product, such as toilet paper, this behavior might provoke the individual to buy a pack of toilet paper themselves (Miri et al., 2020). However, if no one around an individual does anything unusual, this can weaken the individual's perception of the severity of the situation. When expanding the research model with social influence, it could be inserted as a stimulus in the S-O-R model, as in this case, alongside exposure to online information sources. Another way the research model could be expanded is by including other constructs influencing perceived severity such as (1) medical preconditions of oneself or close relatives; (2) medical knowledge and previous exposure to pandemics, which has also been identified as a factor in previous studies (Gamma et al., 2017); (3) proximity of the threat, i.e., knowledge of a neighbor falling ill; and (4) information sources more precisely (specific media outlets, specific social media posts, and so forth).

One final avenue would be to investigate the effects of intervention strategies to curb panic buying. Previous literature has shown that campaigns propagating health knowledge had less impact than expected (Gamma et al., 2017). Campaigns also encouraged people to adopt recommended health measures during the COVID-19 pandemic. For example, in March 2020, healthcare workers globally started an awareness campaign posting images of them working with the catchphrase "We stay at work for you, please stay home for us," that carried a certain weight. During SARS, more healthcare workers died compared to any other professional group in countries such as Singapore (Tan et al., 2006). Such campaigns have cognitive and affective appeal. They are informative in the sense that they remind individuals that healthcare workers are real people putting their lives on the line to save others quite literally during the pandemic. These campaigns are affective as they paint the story of healthcare workers as selfless heroes. These kinds of "hero stories" can reach different groups of people more than strictly information-based communication.

7. Conclusion

In this study, we used the S-O-R model to build a model for understanding reasons influencing individuals' intention to self-isolate and intention to make unusual purchases, a global pandemic. To this end, we collected data from Finnish respondents (N = 211) regarding (1) the online information sources they used to obtain information about COVID-19 (stimuli); (2) how the information affected them (organism); and (3) what kinds of actions they took and intended to take (responses). The empirical results suggested that the number of information sources people were exposed to during March 2020 did not have an impact on their perceived severity of the situation. However, the exposure increased health anxiety as measured by cyberchondria, and consequently, the two measured behaviors, intention to make unusual purchasing and engaging in voluntary isolation. Intention to self-isolate was a strong predictor of unusual purchases, suggesting that a major reason people made unusual purchases during COVID-19 was to prepare for isolation and quarantine. In hindsight, the panic buying phenomenon was brief, and consumer markets quickly stabilized to unusual purchasing and then further to the new COVID-19 consumer status quo. However, the results suggest that as long as people keep self-isolating, they will also keep making unusual purchases. As panic buying is an anomaly, opportunities for empirical data collection on the topic are rare. Accordingly, we encourage scholars to take opportunities to collect empirical data on unusual purchasing whenever a situation presents itself to further expand our knowledge on human behavior during catastrophic situations.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jretconser.2020.102224.

Appendix 1

Survey items and their loadings; CRs and AVEs of the constructs.

Construct	Item	Loading/ weight
Information overload (Whelan et al., 2020a) CR: 0.85 AVE: 0.66	I am often distracted by the excessive amount of information about COVID-19 on multiple channels/sources.	0.83
	I find that I am overwhelmed by the amount of information that I process about COVID-19 on a daily basis from multiple channels/sources.	0.85
	I receive too much information regarding the COVID-19 pandemic to form a coherent picture of what's happening.	0.75
Purchasing self-efficacy (Ling et al., 2019) CR: 0.84 AVE: 0.73	I am able to do extraordinary purchasing if I want.	0.76
	Extraordinary purchasing is difficult for me.	0.93
	Extraordinary purchasing is easy to do.	removed
Exposure to information sources Formative construct (Self-developed)	What are your sources of information regarding Coronavirus (COVID-19) [Select all that applies]:	
	Online newspapers	0.53 ($p < 0.001$)
	Internet searches and websites found	0.28 ($p < 0.05$)
	Social media	0.53 ($p < 0.001$)
	University email	n.s
	University intranet	n.s

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(*continued*)

Construct	Item	Loading/ weight
	THL and government websites	n.s.
Cyberchondria (Jokić-Begić et al., 2019) CR: 0.83 AVE: 0.62	After reading information about COVID-19 online, I feel confused.	Removed
	I feel frightened after reading information about COVID-19 online.	0.78
	I feel frustrated after reading information about COVID-19 online.	0.81
	Once I start reading information about COVID-19 online, it is hard for me to stop.	0.75
Perceived severity (Ling et al., 2019) CR: 0.70 AVE: 0.51	The negative impact of the coronavirus (COVID-19) is very high.	0.60
	Coronavirus (COVID-19) can be life-threatening.	removed
	The coronavirus (COVID-19) is a serious threat for someone like me.	0.81
Intention to make unusual purchases CR: 0.76 AVE: 0.61 (Adapted from Van et al., 2010)	Purchase hygiene products such as face masks and/or hand wash or sanitizers to protect me	0.72
	Stock up food and/or other necessities	0.83
Isolation self-efficacy (Adapted from Ling et al., 2019) CR: 0.81 AVE: 0.59	I am able to take avoidant measures if I want to.	0.84
	Taking avoidant measures is difficult for me.	0.75
	Avoidant measures are easy to take.	0.70
Intention to self-isolate (Adapted from Rubin et al., 2009) CR: 0.83 AVE: 0.56	Deliberately cancel or postpone a social event, such as meeting with friends, eating out, or going to a sports event	0.79
	Reduce using public transportation	0.70
	Avoid going to shops	0.69
	Stay at home and study/work remotely	0.79

Note. THL = Finnish Institute for Health and Welfare.

Appendix 2Loadings and Cross-loadings of the reflective constructs

	Intention to self-isolate	CyberChondria	Information Overload	Online Information Source	Perceived Severity	Intention to make unusual purchase	Purchase Self-Efficacy	Isolation Self-Efficacy
SI1	**0.79**	0.17	-0.01	-0.01	0.25	0.26	0.03	0.27
SI2	**0.70**	0.18	0.02	0.04	0.19	0.35	0.16	0.22
SI3	**0.69**	0.10	-0.01	0.07	0.17	0.35	-0.00	0.15
SI4	**0.79**	0.09	-0.04	-0.01	0.13	0.19	0.04	0.45
PBI1	0.16	0.29	0.23	0.17	0.16	**0.72**	-0.05	-0.06
PBI2	0.39	0.18	-0.02	0.11	0.28	**0.83**	0.17	0.15
CC2	0.19	**0.78**	0.50	0.28	0.30	0.21	0.01	0.04
CC3	0.12	**0.81**	0.55	0.35	0.27	0.18	0.07	-0.10
CC4	0.12	**0.75**	0.40	0.24	0.36	0.30	-0.04	-0.04
IO1	0.04	0.59	**0.80**	0.27	0.12	0.18	-0.04	-0.07
IO2	-0.01	0.55	**0.86**	0.30	0.02	0.04	-0.07	-0.18
IO3	-0.09	0.35	**0.77**	0.26	0.02	0.05	-0.03	-0.22
PS1	0.11	0.30	0.07	0.10	**0.60**	0.20	0.09	0.00
PS3	0.23	0.27	0.03	-0.06	**0.81**	0.22	0.03	0.01
SE1_S	0.39	0.01	-0.13	-0.03	0.04	0.12	0.05	**0.84**
SE2_S	0.26	-0.10	-0.21	-0.17	-0.01	0.03	0.06	**0.75**
SE3_S	0.23	-0.03	-0.11	-0.12	-0.01	-0.04	0.01	**0.70**
SE1_P	-0.09	-0.12	-0.18	0.00	-0.00	-0.02	**0.76**	0.02
SE3_P	-0.09	-0.17	-0.21	-0.06	-0.03	-0.04	**0.93**	0.04

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