

Review

Model Driven Causal Factors of Panic Buying and Their Implications for Prevention: A Systematic Review

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Abstract: Panic buying is a commonly observed response to disasters, and has been widely observed during the COVID-19 pandemic. However, little is known about the variables influencing this behavior. This review summarizes the existing research in this field and examines its implications for the prevention and control of panic buying. **Methodology:** All papers published prior to or during the pandemic, providing an empirically tested model of panic buying behavior (Group A) or a theoretical model supported by literature (Group B), were retrieved through a literature search. For papers in Group A, specific risk or protective factors were extracted and tabulated. Overlaps between Group A and Group B models were identified. Study results were analyzed to identify potential strategies which could limit panic buying behavior. **Results:** It was found that a wide variety of primary (crisis/disease-related), secondary (psychological, informational and sociopolitical), and tertiary (supply chain-related) factors were significantly associated with panic buying, while a single variable-reflective functioning was identified as protective. **Conclusions:** These results provide valuable leads for strategies aimed at preventing or reducing panic buying, particularly in countries still affected by the pandemic. It is hoped that these findings will be useful from both health administration and academic perspectives.

Keywords: COVID-19; panic buying; hoarding; anxiety; stress; social learning; social media



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1. Introduction

Natural or man-made disasters, including disease outbreaks, are often characterized by a scarcity of material resources. This is especially likely to occur if specific aspects of the disaster, such as widespread damage to infrastructure or the fear of contagion, result in restricted mobility of persons and goods [1,2]. In response to this, individuals in affected regions are likely to purchase large quantities of materials that they consider essential, such as food, medications, and items required for child care [3]. A variety of terms have been used to describe this behavior: when it is considered to be a rational or adaptive response, the terms “stockpiling” or “stocking up” have been used [1], while the terms “hoarding” or “panic buying” have been used when the behavior is excessive or compromises attempts at disaster management [4–6].

Reports of panic buying in the medical literature date back to the 1918–1919 influenza pandemic [7]. Subsequently, this behavior has been documented in response to a number of natural or man-made disasters, such as outbreaks of infectious disease, earthquakes, and terrorist attacks [8]. However, though there were numerous media reports of this phenomenon prior to the COVID-19 pandemic, the number of studies systematically investigating the roots of this behavior was small. Due to its global extent and the stringent nature of the measures implemented to contain it, the COVID-19 pandemic has been associated with high rates of panic buying from its earliest stages [9]. The first published mention of panic buying in the context of COVID-19 appeared in a narrative report from

Malaysia in March 2020 [10]; since then, several reports have been published examining this phenomenon from psychological, social and economic perspectives [11].

As COVID-19 is an ongoing global crisis, associated with phasic increases in case transmission in several countries [12,13] and the emergence of new viral variants [14], periods of restricted mobility and disruptions in supply chains remain a matter of concern [15,16]. These periods may be associated with the emergence or re-emergence of panic buying behavior, particularly in areas characterized by economic hardship or social unrest [17]. Panic buying may both exacerbate resource scarcity and expose individuals and groups to a greater risk of infection. For example, panic buying of essentials such as food can lead to acute shortages, and subsequently to price increases, disrupted supply chains and food insecurity in a particular community [18,19]. Similarly, outbreaks of infectious disease may cause individuals to purchase large quantities of medications considered effective against that disease, even when the evidence for their efficacy is inconclusive. This can lead to shortages of these medications in patients for whom such drugs are actually indicated [20,21]. Therefore, it is important to understand the mechanism involved in initiating and maintaining this behavior, in order to devise effective preventive and management strategies [22].

Given these facts, the current review was undertaken with the following objectives in mind:

- (a) To critically evaluate the various model driven causal factors of panic buying proposed in the literature to date, particularly those supported by empirical evidence; and
- (b) To assess the implications of these models for the development, implementation and testing of strategies aimed at preventing or reducing panic buying.

2. Materials and Methods

The review was carried out in three steps. In the first step, the PubMed, SCOPUS, ProQuest and Google Scholar databases were searched for peer-reviewed journal articles containing the terms “panic buying”, “hoarding”, “COVID-19”, “SARS-CoV-2”, “disaster”, “earthquake”, “tsunami”, “outbreak”, “epidemic”, “pandemic” in various combinations, published up to 1 August 2021. A total of 693 citations were retrieved in this manner. After the removal of duplicate citations, 351 citations were identified. Three additional citations were retrieved by searching the reference lists of these papers. A total of 354 papers which were screened for suitability for inclusion in this review. Of these papers, a total of 38 were retained as they described either (a) a model of panic buying that had been subjected to empirical testing, or (b) a model of panic buying that was supported by existing literature. The remaining 316 papers were excluded as they were either: (a) unrelated to panic buying ($n = 192$), (b) commentaries or editorials with no proposed model or empirical evidence included ($n = 95$) or (c) empirical studies of the frequency or correlates of panic buying, but with no proposed model or hypothesis being tested ($n = 29$).

The majority of the 38 papers retained for this review were based on data or models derived from the COVID-19 pandemic ($n = 29$). The remaining nine papers were related to influenza outbreaks ($n = 3$), preparedness in individuals not yet exposed to a disaster ($n = 2$), the Severe Acute Respiratory Syndrome (SARS) outbreak ($n = 1$), Hurricane Irma in the United States ($n = 1$), the Tohoku earthquake in Japan ($n = 1$) and flooding caused by the El Nino meteorological phenomenon in Peru ($n = 1$). For the purposes of this review, papers were classified into two categories:

- Group A ($n = 31$) consisted of papers with a proposed model or hypothesis which had been tested empirically, through a survey or other qualitative research method and appropriate statistical testing. These papers were considered to be of higher value in terms of evidence [23–52];
- Group B ($n = 7$) consistent of papers with a proposed model or hypothesis which had not been tested empirically. Some of these papers were purely theoretical ($n = 3$), while others had support from empirical data but no formal statistical testing ($n = 2$) or were

qualitative studies ($n = 2$). These papers were considered to be of lesser value in terms of evidence [11,53–58].

In the second step, data from the papers in Group A were extracted and tabulated under the following headings:

- Variables included in the proposed model or hypothesis;
- Study methodology;
- Statistical method(s) used;
- Variables confirmed as being significantly associated with panic buying on statistical analysis.

For papers in Group B, data were extracted and tabulated as follows:

- Variables included in the proposed model of hypothesis;
- Available evidence, if any, supporting the hypothesis (for example, published observational or qualitative studies);
- Overlap between the proposed model and findings confirmed empirically in Group A papers.

Following this, the variables identified as significantly contributing to models of panic buying were tabulated and organized according to broad categories.

In the third step, the data derived from Step 2 were used to outline proposals for potential strategies aimed at preventing or minimizing panic buying. In doing this, greater weightage was given to variables or correlates confirmed to be statistically significant in Group A papers.

Given the significant heterogeneity in study hypotheses, methodology and data sources, a formal quantitative meta-analysis could not be carried out.

The study procedure is depicted according to the PRISMA format in Figure 1.

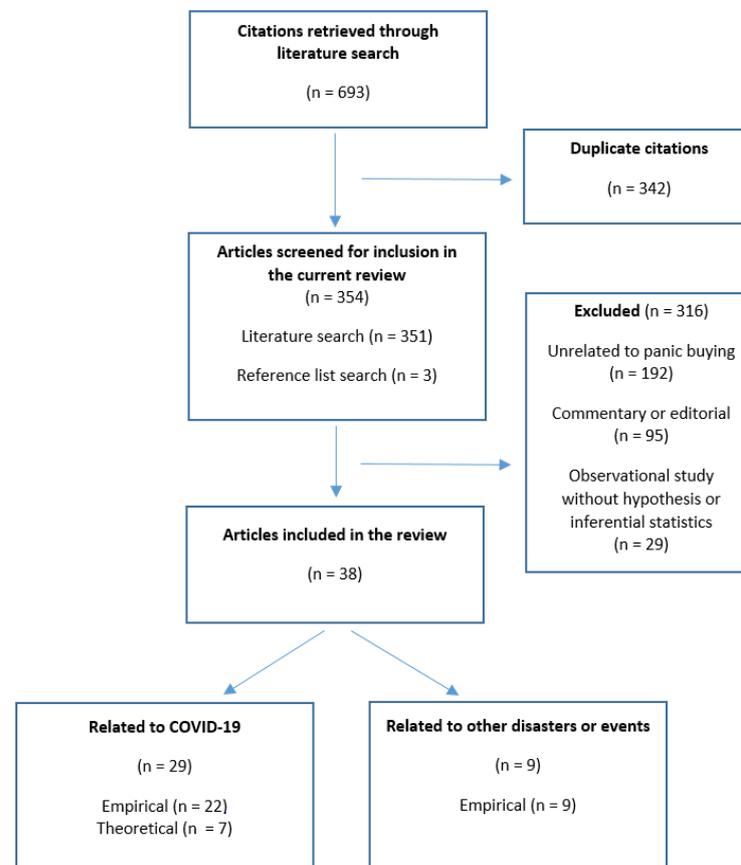


Figure 1. Flow diagram of the articles selected and excluded in the current review.

3. Results

3.1. Model Derived Factors Associated with Panic Buying

Data on the factors associated with panic buying, either directly or indirectly, in evidence-based (Group A) models are presented in Table 1. Studies conducted prior to the COVID-19 pandemic ($n = 9$) identified older age [24,25,27], worry related to the event [24], perceived or actual material scarcity [26,29,30], exposure to information about the event [28–30] and severity of the actual event [30] as possible predictors of panic buying, while findings related to income were inconsistent [23,25]. These studies were generally conducted through direct or telephonic interviews with individuals. In contrast, among studies conducted during the COVID-19 pandemic ($n = 22$), data collection was largely through online platforms. In these studies, the factors identified as influencing panic buying can be broadly classified as follows:

Individual psychological factors: negative affect (including depression, distress or anxiety) [33,34,44,47,50]; prior psychiatric diagnosis [40]; fear or anxiety related to death [33]; perceived arousal or stress [39,52]; cyberchondria [43]; external locus of control [48]; need to belong [41]; mistrust of others [33]; authoritarian (“right-wing”) values [33,34]; perception of scarcity [35,39]; perception of risk, threat or fear related to COVID-19 [34–38,40,43–45,49,50]. The last of these was the most consistently reported correlation of panic buying across studies.

Demographic factors: older age [40], presence of children in the household [33]; higher income [51].

Cultural factors: materialism [41]; individualism [49].

Local/community factors: social contagion through observation of panic buying by peers [32,46,47]; sharing of COVID-19-related information among peers [52].

Disease-related factors: local, national and international pandemic severity [32,41,42]; local transmission of COVID-19 [41]; self-isolation due to the pandemic [43]; income loss due to the pandemic [33]

Media-related factors (including social media): exposure to media reports on the international impact of COVID-19 [37]; exposure to “fake news” or misinformation [32]; exposure to online information about COVID-19 [43,46]; excessive social media usage [39,45]; information overload [38].

Supply-related factors: actual or threatened lockdowns or shop closures [32,37]; actual scarcity of goods [32,39]; interventions by retailers [46].

Government-related factors: internal movement restrictions (lockdowns, stay-at-home orders) [42,46]; stimulus measures [32,42].

Certain protective factors were also identified in these reports. These include a sense of self-efficacy [25], reflective functioning [33], social support or connection with others [25,45], higher education [50], and local availability of essential materials such as food and healthcare products [50]. Apart from social support, none of these was replicated across studies in different countries or contexts.

Table 1. Factors associated with panic buying in empirically tested models.

Study and Country	Type of Event	Variables Included in Model	Study Methods	Statistical Method(s) Used	Variables Confirmed on Data Analysis
Buchholz et al., 2007; Germany [23]	Influenza outbreak	Demographic variables—age, sex, social class, region (I) Level of knowledge about influenza and anti-viral drugs (I)	Telephonic survey of 3116 German citizens	Univariate analyses	Higher social class
Gasink et al., 2009; USA [24]	Influenza outbreak (H5N1)	Demographic variables—age, sex, ethnicity (I) Level of worry about avian influenza (I)	Direct survey of 508 American citizens	Univariate analyses	Older age White ethnicity High level of worry about influenza
Loke et al., 2012; Hong Kong [25]	None; assessment of disaster preparedness	Age (I) Self-efficacy (I) Family support (I) Social support (I)	Telephonic survey of 1137 Hong Kong residents	Binary logistic regression	Older age Self-efficacy (protective) Social support (protective)
Thomas et al., 2011; New Zealand [26]	None; assessment of earthquake preparedness	Resource availability (I) Aid provision (I) Individual values (I) Income (I) Disaster-induced value changes (I)	Direct survey of 172 New Zealand residents attending an earthquake preparedness workshop	Stepwise linear regression	Non-availability of resources Sense of responsibility Low income Perception of no or low aid provision
Hori and Iwamoto, 2013; Japan [27]	Tohoku earthquake	Demographic variables (I) Availability of materials (I) Price of materials (I)	Analysis of survey dataset on consumer behavior of 12,000 Japanese households	Probit regression	Urban residence Larger household Older age and unemployment of wives
Qiu et al., 2018; China [28]	Influenza (H7N9) and SARS outbreaks	Reliability of information regarding the disease (I) Governmental measures (I) Media reporting on outbreaks (I) Restrictions on mobility (I)	Semi-structured interview of 26 stakeholders during both outbreaks	Descriptive statistics only	Misinformation regarding foods/medicines considered “preventive” Media reports of deaths Overall impact greater for SARS than H7N9
Li et al., 2018; China [29]	Influenza outbreak (H7N9)	Availability of materials (I) Media reports of material scarcity (I) Price of materials (I)	Analysis of transportation data and media reports	Clustering analysis	Non-availability of materials Media reports of material scarcity

Table 1. Cont.

Study and Country	Type of Event	Variables Included in Model	Study Methods	Statistical Method(s) Used	Variables Confirmed on Data Analysis
Khare et al., 2019; USA [30]	Hurricane Irma	Social media (Twitter) exposure (I) Content of social media postings (“tweets”) (I)	Analysis of ≈1000,000 tweets over 3 days during the hurricane	Poisson regression	Local population Availability of materials Social media usage Issue of official warnings regarding the hurricane
Alatrasta-Salas et al., 2021; Peru [31]	El Nino meteorological phenomenon	Severity of rains/flooding (I) Availability of materials (I) Type of materials (I)	Analysis of merchant and bank data related to purchases in Peru, 2017	Coarse- and fine-grained causality analysis	Severity of flooding Type of materials (healthcare and food products)
Ahmed et al., 2020; USA [32]	COVID-19 pandemic	Fear of lockdown (I) Peer buying (I) Scarcity of essentials (I) Limited supply of essentials (I) Stimulus cheques (I) Fear appeal (Med) Fake news on social media (Med) Pandemic severity (Mod)	Survey of 889 US consumers: offline ($n = 580$) and online ($n = 309$)	Structural equation modelling	<i>Fear of lockdown</i> Peer buying by others in the community Scarcity of essentials <i>Limited supply of essentials</i> Stimulus cheques Fear appeal Fake news on social media Pandemic severity
Bentall et al., 2021; UK and Republic of Ireland [33]	COVID-19 pandemic	Infection-related factors (I) Presence of children at home (I) Falling income (I) Mistrust of others (I) Depression and anxiety (I) Scarcity cues (I) Falling background rate (I) Neuroticism (Mod) Locus of control (Mod) Intolerance of uncertainty (Mod) Death anxiety (Mod) Right-wing authoritarianism (Mod) Reflective functioning (Mod) Income (Mod)	Online survey of adult general population in UK ($n = 2025$) and Ireland ($n = 1031$)	Multivariate regression analysis	Presence of children at home Falling income Mistrust of others Depression (Mod) Death anxiety (Mod) Holding right-wing authoritarian beliefs (Mod) Reflective functioning (protective)

Table 1. Cont.

Study and Country	Type of Event	Variables Included in Model	Study Methods	Statistical Method(s) Used	Variables Confirmed on Data Analysis
Bohicchio et al., 2021; Italy [34]	COVID-19 pandemic	Negative affectivity (I) Right-wing authoritarianism (I) Anxiety of infection (Mod)	Online survey of Italian adult general population ($n = 757$)	Structural equation modelling	Negative affectivity Holding right-wing authoritarian beliefs Infection anxiety (Mod)
Chua et al., 2021; Singapore [35]	COVID-19 pandemic	Perceived susceptibility to infection (I) Perceived severity of COVID-19 (I) Perceived outcome of purchasing (I) Cues to action (I) Self-efficacy (I) Perceived scarcity (Med) Anticipated regret (Mod)	Online survey of adult population, Singapore ($n = 508$)	Structural equation modelling	Perceived susceptibility Perceived outcome of purchasing Cues to action Self-efficacy Perceived scarcity (partial Med) Anticipated regret (Mod)
Cyprianska et al., 2020; Poland [36]	COVID-19 pandemic	Perceived threat of COVID-19 (I) Anxiety (Mod) Hopelessness (Mod) Panic (Mod)	Online survey of adults, Poland ($n = 1028$)	Multivariate regression and mediation analysis	Perceived threat of COVID-19 Panic (Mod)
Hall et al., 2021; New Zealand [37]	COVID-19 pandemic	National/international media reporting (I) Perceived threat of lockdown (I)	Details of retail spending and transactions, pre- and post-COVID-19	Time series analysis	International media reporting Perceived threat of lockdown
Herjanto et al., 2021; USA [38]	COVID-19 pandemic	Perceived risk (I) Situational ambiguity (I) Thinking style (judicative, executive or legislative) (I) Information overload (Mod)	Online survey of college staff and students, US ($n = 139$)	Structural equation modelling	Perceived risk Situational ambiguity Judicative thinking style Information overload (partial Mod)

Table 1. Cont.

Study and Country	Type of Event	Variables Included in Model	Study Methods	Statistical Method(s) Used	Variables Confirmed on Data Analysis
Islam et al., 2021; (China, India, Pakistan, USA) [39]	COVID-19 pandemic	Limited quantity scarcity (I) Limited time scarcity (I) Perceived arousal (Med) Excessive social media use (Mod) Impulsive urges to buy (Mod)	Online survey of adult general population; China ($n = 345$), India ($n = 334$), Pakistan ($n = 261$), US ($n = 151$)	Structural equation modelling	Limited quantity scarcity Limited time scarcity Perceived arousal (Med) Excessive social media use (Mod, except in India) Impulsive urges to buy (Mod, except in India)
Jaspal et al., 2020; UK [40]	COVID-19 pandemic	Demographic variables (age, sex, income) (I) Prior psychiatric illness (Med) Social support (I) Fear of COVID-19 (I) Political trust (I) Self-isolation (I)	Online survey of adult general population, UK ($n = 441$)	Structural equation modelling	Older age Prior psychiatric diagnosis (Med) Fear of COVID-19
Jin et al., 2020; China [41]	COVID-19 pandemic	Pandemic severity (I) Materialism (Med) Need to belong (Mod)	Online survey of adult general population, China in February 2020 ($n = 1548$) and follow-up in August 2020 ($n = 463$)	Multivariate regression analysis	Pandemic severity Materialism (Med) Need to belong (Mod)
Keane and Neal, 2020; 54 countries [42]	COVID-19 pandemic	Domestic virus transmission (I) Global virus transmission (I) Internal movement restrictions (I) Travel restrictions (I) Stimulus announcements (I)	Google search data and information on governmental policies for 54 countries, March 2020	Econometric model: log-linear regression analysis	<i>Domestic virus transmission</i> <i>Global virus transmission</i> <i>Internal movement restrictions (particularly early)</i> Stimulus announcements
Laato et al., 2020; Finland [43]	COVID-19 pandemic	Exposure to online information sources (I) Self-efficacy Intention to self-isolate (I) Information overload (Med) Cyberchondria (Med) Perceived severity of COVID-19 (Med)	Online survey of adult general population, Finland ($n = 211$)	Structural equation modelling	Exposure to online information Intention to self-isolate Cyberchondria (Med) Perceived severity of COVID-19 (Med)

Table 1. Cont.

Study and Country	Type of Event	Variables Included in Model	Study Methods	Statistical Method(s) Used	Variables Confirmed on Data Analysis
Lee et al., 2021; Taiwan [44]	COVID-19 pandemic	Risk perception (I) Trust in social media (I) State anxiety (Med)	Survey of students purchasing protective equipment, Taiwan ($n = 180$)	Multivariate regression analysis	Risk perception Trust in social media State anxiety (Med)
Li et al., 2021; China [45]	COVID-19 pandemic	Perceived risk of COVID-19 (I) Connection with others (Med) Social media usage (Med)	Online survey of adult general population, China ($n = 972$)	Mediation analysis	Perceived risk of COVID-19 Social media usage (Med) Connection with others (protective)
Prentice et al., 2020; USA and Australia [46]	COVID-19 pandemic	Government measures (I) Social media coverage (I) Peers' panic buying behavior (I) Fear of missing out (I) Retailer interventions (Mod)	Online survey of adult general population, United States ($n = 381$) and Australia ($n = 50$)	Structural equation modelling	Government measures Social media coverage Peers' panic buying behavior Retailer interventions (Mod)
Putri et al., 2020; Indonesia [47]	COVID-19 pandemic	Media credibility (I) Social contagion (I) Consumer anxiety (I, Med)	Online survey of adolescent/adult general population, Indonesia ($n = 350$)	Structural equation modelling	Social contagion Consumer anxiety (I, Med)
Syahrivar et al., 2021; Indonesia [48]	COVID-19 pandemic	COVID-19-related knowledge (I) Locus of control (I) Perceived risk of COVID-19 (Med)	Online survey of university faculty, Indonesia ($n = 265$)	Structural equation modelling	External locus of control
Tse et al., 2021; USA, UK, Germany, Hong Kong [49]	COVID-19 pandemic	Perceived threat due to COVID-19 (I) Moral identity (I) Cultural individualism/collectivism (Mod)	Online survey of adults, four countries (USA, UK, Germany, Hong Kong) ($n = 916$)	Mediation analysis	Perceived threat due to COVID-19 Cultural individualism (Mod)
Wang and Na, 2020; China [50]	COVID-19 pandemic	Demographic variables (age, sex, income) (I) Current availability of materials (I) Perceived risk of infection (I) Self-reported psychological status (I) Attitude towards group uniformity (I) Local lockdown/shop closure (I) Income loss due to COVID-19 (I)	Online survey of adult general population, China ($n = 540$)	Probit regression	Perceived risk of infection Poor self-reported psychological status Education (protective) Availability of materials (protective)

Table 1. Cont.

Study and Country	Type of Event	Variables Included in Model	Study Methods	Statistical Method(s) Used	Variables Confirmed on Data Analysis
Yoshizaki et al., 2020; Brazil [51]	COVID-19 pandemic	Per capita income (I) Access to stores/shops (I)	Data from retailers and census data regarding per capita income, Brazil	Multivariate regression analysis	Higher per capita income
Zhang and Zhou, 2021; China [52]	COVID-19 pandemic	Perceived risk of COVID-19 (I) Psychological stress (I) Perceived risk of being outside (I) Safeguarding behaviors (I) Sharing information about COVID-19 (I)	Online survey of adult general population, China ($n = 189$)	Multivariate regression analysis	Psychological stress Sharing information about COVID-19

Abbreviations: I: independent variable; Med, mediator variable; Mod, moderator variable. Variables marked in italics were flagged by the respective researchers as being most significant. Variables marked in bold were protective factors.

3.2. Theoretical Models of Panic Buying

We identified seven proposed models that are yet to be tested empirically. These theoretical models, along with the evidence supporting them and their overlap with Group A models, are presented in Table 2. All these models were derived from observations related to the COVID-19 pandemic. Several factors proposed by these models were consistent with the evidence from empirically-derived models. These included perceptions of threat [53,54,58], peer buying behavior [53,55,58], fear of the COVID-19 pandemic [11,53,54,58], individual psychological factors [11,53,57,58], sociopolitical influence [11,55], perceived scarcity and high demand for essential products [11,54,58], price fluctuations [11], perceived uncertainty [54,55,58], supply disruptions [55], pandemic severity [56] and information overload, particularly through social media [56,57].

Table 2. Theoretical, simulated or qualitative models of panic buying.

Study	Variables Included in Model	Supporting Evidence Cited in Paper	Overlap with Group A Research
Alchin, 2020 [53]	Perceived threat of pandemic Peers' panic buying Anxiety/fear	None	Perceived threat or risk [24,34–38,40,43–45,49,50]; peers' panic buying [32,46,47]; anxiety [33,34,44,47]
Arafat et al., 2020 [11]	Pandemic/disaster event Psychological factors Information system Sociopolitical influence Sense of scarcity High product demand Importance of the product Anticipation of price hike	Assessment of 613 media reports of panic buying	Psychological factors [33–37,40,41,43–45,48–50]; information system [28,32,37–39,43,45,46]; socio-political influence [32,42,46]; sense of scarcity [29,32,35,37,39].
Dickins and Schalz, 2020 [54]	Socioeconomic status Perceived risk to life Uncertainty Perceived food scarcity	None	Socioeconomic status [33,51]; perceived risk [34–38,40,43–45,49,50]; perceived scarcity [29,32,35,37,39]
Kaur and Malik, 2020 [55]	Supply disruptions Demographic bursts Emotional contagion Inability to tolerate distress	Qualitative analysis of responses from 22 store operators	Supply disruptions [29,32,37,39,46]; emotional contagion [32,46,47]
Li et al., 2020 [56]	Local pandemic severity Social contagion Communication via social media	Computer simulation	Pandemic severity [32,41,42]; social contagion [32,46,47]; communication via social media [30,39,44–46]
Naeem, 2021 [57]	Social media exposure and communication Individual perception Individual expectation	Qualitative analysis of responses from 34 adults, United Kingdom	Social media exposure and communication [30,39,44–46,52], individual perception [35,36,38,43–45,49,50]
Rajkumar, 2021 [58]	Actual or threatened scarcity Illness-related fears Negative affect Lack of social contact or support Uncertainty Materialism Social learning	Review of existing literature on the correlates of panic buying	Scarcity [29,32,35,37,39,46]; illness-related fears [24,34–38,40,43–45,49,50]; negative affect [33,34,44,47,50]; materialism [41]; social learning [32,46,47]; lack of social support [25,45]

It may be observed that there is a significant degree of overlap between variables identified as contributing to panic buying in Group A models and those theorized to do so in Group B models. This suggests that they might be parsimoniously synthesized into a single comprehensive model. On examining the variables identified in this review, it was found that they could be conveniently grouped into three categories, which correspond to those identified in media reports [11]:

- Primary factors, which are those related directly to the pandemic or other catastrophic event, such a natural or man-made disaster.
- Secondary factors, which modulate the response at the individual or community level. These can be further classified into psychological, informational and socio-political factors.
- Tertiary factors, which are related to supply and demand.

A list of variables contributing to panic buying, organized according to this framework, is presented in Table 3.

Table 3. Factors associated with panic buying, arranged by category.

Domain	Factors
Primary (Disease- or disaster-related factors)	Severity and duration of the event Regional, national and international disease transmission (for disease outbreaks) Indirect effects of the outbreak—loss of life, loss of income, social isolation
Secondary-Psychological	Anticipated regret Arousal Cyberchondria Fear (of lockdown, of death, of infection) Impulsive urges to purchase Mistrust of others Need to belong Negative affect (depression, anxiety) Perception (of disease risk, of positive outcomes of buying, of ambiguity, of scarcity) Psychological stress Right-wing authoritarian attitude Self-efficacy Thinking style (judicative)
Secondary-Informational	Appeals to fear in media Cues to action in media/social media Excessive use of social media Exposure to online information Fake news/misinformation on social media Information overload Media coverage of the event and its outcomes (e.g., death) Sharing of information online Trust in social media
Secondary-Sociocultural and Political	Cultural values (materialism, individualism) Government measures Internal mobility restrictions Peer buying behaviors and social contagion Stimulus measures
Tertiary (Supply and Demand-Related Factors)	Limited supply of essentials Retailer interventions Scarcity of essentials
Protective	Individual: Self-efficacy; reflective functioning Community: Social support or connection with others Supply-related: Local availability of essential materials

The manner in which these factors interact to influence panic buying is illustrated in Figure 2. It can also be observed from this diagram that panic buying further exacerbates shortages of essentials, amplifies peer behavior through social learning, and may invite restrictive measures from local or national governments.

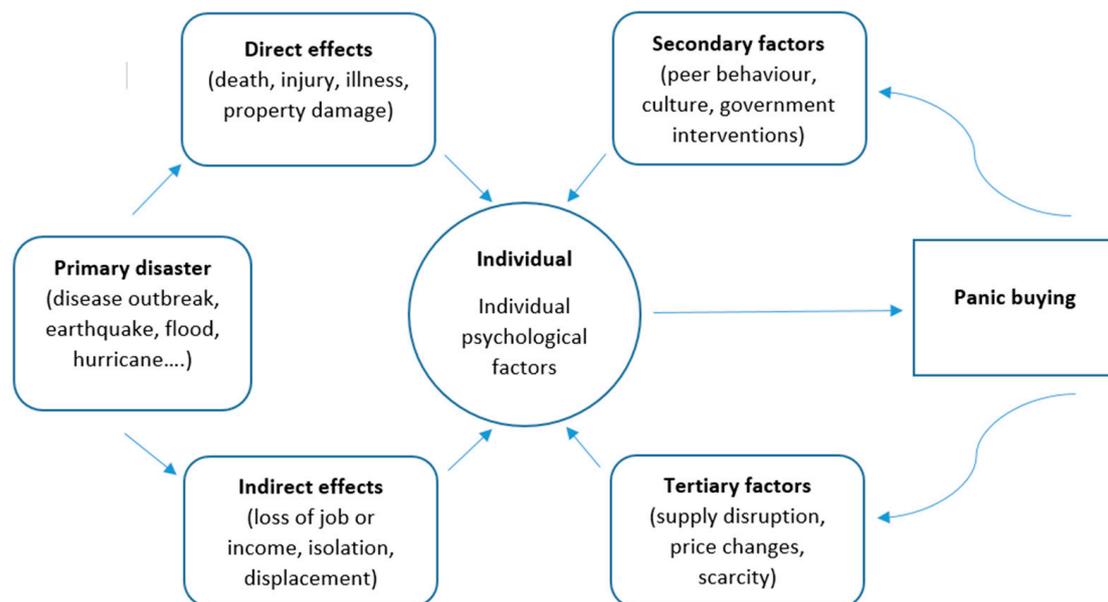


Figure 2. A schematic representation of how various factors interact to influence an individual's likelihood of panic buying. The curved arrows indicate ways in which panic buying can act in a self-reinforcing manner to some extent.

4. Discussion

We aimed to extract the model derived factors for panic buying by a systematic search. We scrutinized 38 articles to identify potential risk factors and divided these articles into an empirically tested group (Group A) and theoretical proposals (Group B).

4.1. Key Findings of The Study

There were several factors potentially associated with an increased likelihood of panic buying (Tables 1 and 2) which can be logically organized into three categories, as outlined in Table 3. From this list, it is clear that the majority of factors identified as influencing panic buying to date operate at the level of the individual. This is probably due to the fact that most studies modelling panic buying have been based on surveys of members of the general population. In this form of research, individual factors are easier to operationalize and measure than broader social or economic factors. While this does not minimize the importance of individual variables, it does highlight an important limitation of the available literature, and a need to devise alternative methodologies to model these higher-level factors.

It is also significant that, next to individual psychological variations, factors related to media reporting, and particularly to online or social media have been most consistently identified as influencing panic buying. This suggests that, in modern times, any strategy aimed at minimizing this behavior would have to take these means of communication into account and use them effectively.

Among social factors, peer buying behaviors were identified as an important influence both in theoretical models [53,56,58] and in tested hypotheses [32,46,47]. This suggests that though panic buying at the individual level may be more directly related to psychological factors and living circumstances, the spread of these behaviors at the level of neighborhoods or communities is influenced by social learning, or what has been termed "social contagion" [47,53].

The risk factors identified in empirically tested models overlap to a large extent with the factors identified from a review of media reports [11], indicating a certain degree of concurrent validity for these variables. The various factors identified above should not be seen as specific “causes” of panic buying, but as interacting variables that may increase or decrease the probability of engaging in such behavior [59]. While the basic urge to engage in panic buying may represent an evolutionarily primitive behavior pattern [58,60], it is also influenced by higher-order cognitive appraisals and social learning [53,60]. The literature to date has focused on testing small numbers of factors in individual studies. Yet, it should be possible, in principle, to quantify the relative contributions of the various factors listed in Table 3 in larger samples, and across several countries and cultures. Several of these factors are potentially modifiable, which implies that strategies to prevent or minimize panic buying are possible. These will be discussed in the next section.

It is also worth noting that there is significant coherence between factors identified as relevant to panic buying in the pre- and post-COVID-19 literature. Higher social class/income, exposure to media information, and worries about an infectious disease were identified as risk factors in both these subsets of the literature [20,23,24,30,34–39,44–46,51], while social support was found to be protective [25,45]. This suggests that the findings derived from observations made during the COVID-19 pandemic may apply, *mutatis mutandis*, to other large-scale disasters or disease outbreaks. However, further research is needed to delineate the impacts of specific forms of disaster on panic buying. For example, a natural disaster such as an earthquake or hurricane may lead to significant immediate deaths, property destruction and supply chain disruption [61], but not the persistent risk of contagion, gradual increase in deaths or containment measures that would occur during a pandemic [62]. Thus, while factors influencing panic buying may be similar across situations, the exact duration and intensity of this behavior may be critically influenced by the nature of the catastrophic event itself.

An important factor that is hinted at in the existing literature, but requires further investigation, is the relationship between panic buying, current mental health status, and past psychiatric disorders. Theoretically, panic buying may be linked to symptoms of anxiety or obsessive-compulsive disorder [9,53,58], and the presence of acute psychological distress, depressive symptoms, or prior psychiatric diagnoses were all identified as risk factors for panic buying [33,40,50]. Though panic buying is not in itself a disorder or a symptom of any disorder, it may be more likely to occur in conjunction with symptoms of common mental disorders. Selected and indicated prevention strategies could be considered in this sub-group.

Finally, the role of cultural and economic factors should not be overlooked. Certain cultural values, such as materialism and individualism, may be associated with an increased likelihood of panic buying; similarly, economic factors such as changes in price, restrictions imposed by retailers, or financial assistance from governments may lead to temporary increases in this behavior. While the latter finding may appear paradoxical, it is consistent with the observation that a higher income predicts panic buying: the availability of financial resources may strengthen a pre-existing impulse to hoard or purchase excessively. While retailer and government interventions are necessary and often desirable, their potential impact on panic buying should be taken into account prior to implementing them.

4.2. Deriving Strategies to Prevent or Mitigate Panic Buying from the Available Evidence

Based on the results of the research reviewed in the paper, it is possible to outline several approaches that may be useful in preventing or controlling panic buying. From a primary perspective, it is clear that methods aimed at controlling the spread of COVID-19, and providing effective care to patients, may reduce panic buying by reducing local disease burden and severity. These measures, which have been extensively reviewed elsewhere [63], should be supplemented by the provision of public health information in a clear and culturally appropriate manner. This would aid in countering misconceptions or exaggerated appraisals of risk, which are additional risk factors for panic buying [11,60].

More specific interventions can be provided at the secondary level. From a psychological perspective, a combination of cognitive and behavioral approaches can aid in minimizing factors such as anxiety, unrealistic fears and errors in appraising a situation, in helping individuals understand the links between negative emotions and the urge to purchase and in modelling more adaptive ways of handling the difficulties caused by the pandemic. These approaches, which can be delivered using Internet-based or mobile platforms, have been lucidly outlined by Kar et al. [64]. Such techniques can be supplemented by teaching general methods of stress management, adaptive coping, and lifestyle modification [65], which have also been associated with a lower risk of panic buying [66]. From an informational perspective, the available evidence suggests that exposure to misinformation or exaggerated news reports, particularly on social media, can exacerbate panic buying. Therefore, it is important to liaise with media outlets and popular news sources to ensure that stories related to COVID-19 are reported accurately, with a greater reliance on facts and expert opinion, and a minimization of unfounded speculations or rumors [67]. This may be achieved both through regulation by governments and media platforms, and by “informal pressure” from sources providing more accurate and balanced information [68]. From a *socio-political* perspective, measures taken by governments to ensure economic and food security and minimize the scarcity of essential resources can reduce panic buying, as failures in these areas have historically been associated with “outbreaks” of this behavior [69].

Approaches at a tertiary level overlap to some extent with the informational and socio-political strategies, and may include the avoidance of exaggerated media stories or images regarding hoarding, as well as realistic reassurance from local authorities. In addition, rationing strategies may ensure that individual shoppers are able to obtain sufficient goods for themselves without affecting others in the community [70]. Similarly, local and national authorities and retailers should anticipate the likelihood of increased panic buying immediately before and after lockdowns, and following stimulus measures [32,42]. In this way, appropriate measures may be taken to minimize the consequences of this behavior.

Finally, studies have identified self-efficacy and reflective functioning as protective factors against panic buying [25,33]. Though these results require replication, they are significant because they represent possible pathways to resilience in a disaster or pandemic setting. Self-efficacy, which measures an individual’s sense of competence and ability to cope with a given situation regardless of circumstances, has been associated with greater preparedness for disasters [71], which may reduce the risk of subsequent panic buying. Reflective functioning—which refers to the capacity to reflect on one’s own and other’s mental states—has been associated with positive mental health and resilience in other settings [72]. Psychological interventions aimed at improving self-efficacy and reflective functioning, which are already used in other contexts [73,74], may prove to be an important.

4.3. Novelty of the Current Findings

The current paper adds to the existing literature through its systematic methodology and incorporation of the latest evidence. Though prior reviews addressing the issue of panic buying during the COVID-19 pandemic have been published [22,60,70], these have been largely narrative in nature, without an analytical component. This review, while consistent with earlier publications, is the first to summarize and systematically classify the factors influencing panic buying, based on evidence from large-scale surveys and sophisticated statistical models. Some of the risk factors and mechanisms proposed in earlier reviews, such as anxiety [33,34,44], fear of scarcity [29,32,35,37], social contagion [32,46,47] and government measures [32,42], have been supported by our review of the existing data. Other factors considered relevant in the earlier reviews, such as specific coping strategies, did not receive empirical support. Moreover, this review has identified several potential risk factors not flagged in these reviews, such as older age, household composition, specific social and political attitudes, higher income and cultural values, as well as possible protective factors at the individual and community levels. It is hoped that the wider range of results covered in this review will aid in developing evidence-based strategies aimed at

reducing panic buying, which can be subjected to empirical testing. It is also hoped that the summary of research findings provided in this article will be of use to future researchers in their attempts to develop a more wide-ranging and holistic model of the various factors influencing this behavior.

4.4. Strengths and Limitations

This review is subject to certain significant limitations. First, it is based on a relatively small number of original research papers, covering only a small fraction of the countries that have been affected by COVID-19; hence, the findings presented here may not apply to different cultures and settings. Second, for methodological reasons, most included studies have focused on individual psychological variables; therefore, disease-related, sociopolitical, and supply-related factors have been under-represented. Third, the local impact of the pandemic, in terms of case load and mortality, has varied widely across the countries in which this phenomenon has been studied, and this could not be corrected for due to the heterogeneity in study designs and variables. Fourth, most studies have considered “panic buying” as a unitary phenomenon, whereas in real-world settings, different factors may influence panic buying for specific types of goods, such as food supplies, medications and healthcare products [75]. Finally, there is always a possibility of publication bias influencing the nature of the studies included in this review.

5. Conclusions

Despite these limitations, the existing literature has identified certain individual and societal factors that are significantly associated with panic buying. An important future task would be to identify or formulate an appropriate theoretical framework to understand the interactions between these risk factors. For example, factors such as the antecedent effects of risk or threat perception, the appraisal of external cues such as media reports, attendant emotional responses such as fear or anxiety and the resultant behavior of panic buying can be understood using a cognitive-behavioral framework [60,76]. These individual factors may interact with various facets of culture, such as power distance, individualism, long-term orientation and indulgence, as proposed in Hofstede’s model of culture, to influence specific behaviors in the context of a disaster situation [77]. Finally, resilience factors and their impact on an individual’s likelihood to indulge in harm-avoiding behaviors (in this context, avoiding panic buying) versus impulsive behaviors (in this context, panic buying), should be studied [78]. This evidence can be used to formulate multi-level intervention strategies to minimize the risk of this behavior and encourage alternate coping strategies, particularly as several countries face second or third “waves” of the COVID-19 pandemic. This information would also be valuable in building resilience in the face of future disease outbreaks or other catastrophic events.

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