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**ABOUT COVER**

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## How far has panic buying been studied?

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### Abstract

#### BACKGROUND

Although panic buying (PB) is a ubiquitous behavior, it became prominent during the coronavirus disease 2019 pandemic. However, studies are inadequate to explore the different aspects of it, even though it covers several perspectives of life and academic domains.

#### AIM

To assess the research that have been conducted on PB.

#### METHODS

A search was conducted to identify the articles in PubMed, PubMed Central, Scopus, and Google Scholar using the search term "panic buying" on November 15, 2020. A total of 104 articles was extracted from the initial search. After removing duplicates and initial and full-text screening, 42 articles were included in the study. We only considered peer-reviewed published articles that can be downloaded in a full portable document format. Articles published in other languages and preprints were excluded.

#### RESULTS

Among the 42 articles, 27 were original contributions, 6 were correspondences, 3 were commentaries, 3 were review articles, and there was one each for editorial, opinion, and discussion type of articles. Several domains have been researched

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such as psychology, responsible factors, supply chain, management, disaster preparedness, e-commerce, consumer behavior, marketing, prevention strategies, media, social network, economics, personality, and engineering. Authors from several disciplines, such as psychiatry, management, economics, business, sales and marketing, consumer behavior, public health, communication, information management, sociology, engineering, business administration, psychology, nursing, health economics, food policy, epidemiology, and community health, have been studied it. Definition, causative model, econometric model, controlling strategy, and measuring instrument have been reported. A total of 18 papers had cross-country collaboration, and ten were funded projects. Most of the authors were affiliated with the institutions of Australia, Bangladesh, China, India, Singapore, and the United States.

## CONCLUSION

PB is a relatively newer concept to get the attention of the research community. Further robust studies with replication of the findings are warranted to explore, predict, and control during crises.

**Key Words:** Panic buying; Systematic review; COVID-19; Pandemic; Disaster; Supply chain

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**Core Tip:** Panic buying is an under-researched emerging research problem. Although it covers several aspects of human life, there is a dearth of studies. This review was aimed to assess the extent of research that has been done on panic buying. A total of 42 papers were included after a systematic search. Several domains have been researched such as psychology, responsible factors, supply chain, management, disaster preparedness, e-commerce, consumer behavior, marketing, prevention strategies, media, social network, economics, personality, and engineering. Definition, causative model, econometric model, controlling strategy, and measuring instrument have been reported.

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## INTRODUCTION

Panic buying (PB) is an interesting behavioral phenomenon, usually noticed among the public in the face of disasters. The term “panic buying” consists of two words “panic” and “buying,” which refer to the affective and behavioral components of this phenomenon. It has some common roots with stockpiling<sup>[1]</sup>. The coronavirus disease 2019 (COVID-19) pandemic has witnessed an increase in PB behavior globally, irrespective of the socioeconomic status of the country<sup>[2,3]</sup>. It has been conceptualized as “the phenomenon of a sudden increase in buying of one or more essential goods in excess of regular need provoked by adversity, usually a disaster or an outbreak resulting in an imbalance between supply and demand”<sup>[4]</sup>. Several intermingled factors interact with each other to influence it, pointed out as primary (provoking stimuli), secondary (media and psychosocial aspects), and tertiary (utility, demand, and price of the goods) factors<sup>[2]</sup>. Multiple psychological explanations have been proposed such as anticipation of shortage and price hike, supply disruption, fear, uncertainty, maladaptive coping, and maintaining control over the environment to attribute it<sup>[2,5-7]</sup>. There are complex interactions between media, environment, rumor, and increased demand and price as these factors can have a bidirectional role with PB<sup>[2,3,6,8]</sup>. It has been traced in response to an adverse stimulus, such as COVID-19, pandemic, war, government's declaration, any policy change, disaster, *etc.*<sup>[2,9]</sup>.

Theoretically, PB shares multiple aspects of human life and several domains of



academia. It is related to behavior, public health, disaster preparedness, mass media, economics, sociology, business, marketing, supply chain, industrial buying and production, e-commerce, and so on<sup>[8]</sup>. However, there is a dearth of studies exploring the different aspects of it. Although studies are recently coming out, the issue is still under-researched. With this background, we aimed to conduct a review to assess the extent of research on PB that has been conducted.

## MATERIALS AND METHODS

### Article search

A search was done to identify the articles in PubMed, PubMed Central (PMC), Scopus, and Google Scholar (GS) with the search term “panic buying” on November 15, 2020. A total of 104 (PubMed = 19, PMC = 22, Scopus = 30, GS = 33) articles were extracted from the initial search. Subsequently, 44 duplicate articles were removed, and the remainder of the 60 articles were screened. After screening the abstract, another 14 articles were removed as PB was not identified as a study variable. Then, full texts were screened resulting in the removal of four articles because the articles only mentioned PB without discussing its aspects. Finally, 42 articles were included in the study (Figure 1).

### Inclusion criteria

We included peer-reviewed published articles that were extracted from the search and downloadable as full portable document format in the study.

### Exclusion criteria

Articles published in other languages (for example, Bangla, German, Chinese, and French) and preprints were excluded from the study.

### Outcome variables

Type of research, publishing year, applied method, key findings, the geographical distribution of the authors, specialty of authors, collaboration (intracountry or intercountry), a major subject of the journal where the articles published, a principal domain discussed in the article, funding status, and keywords were outcome variables. We considered the first authors' and corresponding authors' affiliated institutions' location to describe the authors' geographical locations.

### Statistical analysis

In the current study, we assessed the aspects of PB research, detail statistical analysis was not performed. We did a word cloud of the keywords of the articles to reveal highlighting search terms mentioned in the articles.

### Ethical statement

The study was conducted complying with the Declaration of Helsinki (1964). As we analyzed the publicly available media reports, no formal ethical approval was sought.

## RESULTS

### Distribution of the studies

In this review, we searched articles from PubMed, PMC, Scopus, and GS, and 42 articles were reviewed. The articles were published between 2002 and 2020 whilst 36 papers were published in 2020 (Table 1). Among the selected articles, 27 were original articles, 6 were correspondences, 3 were commentaries, 3 were review articles, and 1 each were editorial, opinion, and discussion type of articles (Table 1).

### Applied methods

Nine studies surveyed the target population online or offline, five studies applied cross-sectional data analysis, four papers studied social media, three studies analyzed media reports, and two studies mined data from Google search volume using Google Trends application programming interface (Table 1).

Table 1 Summary of the articles

No.	Ref.	Year	Type	Title	Method applied	Key message
1	Ahmed <i>et al</i> <sup>[10]</sup>	2020	Original	The COVID-19 pandemic and the antecedents for the impulse buying behavior of US citizens	Survey (online and offline)	This study sorted out nine variables from the literature that may influence impulsive buying and tested them by conducting surveys in major United States cities. The variables include fear of complete lockdown, peer buying, the limited supply of essential goods, empty shelves, United States stimulus checks, panic buying, fear appeal, social media fake news, and COVID-19.
2	Alchin <sup>[11]</sup>	2020	Commentary	Gone with the wind		This paper proposes a definition of “panic buying,” with references to literature, philosophy, and contemporary neurobiology. The self-fulfilling prophecy, the contagion model of emotional propagation, the Polyvagal Theory, and Nietzsche’s study of the classical tragedy were discussed in relation to panic buying.
3	Alfa <i>et al</i> <sup>[12]</sup>	2020	Original	Effect of panic buying on individual savings: The COVID-19 lockdown experience	Cross-sectional	The paper assessed the microeconomic effect of PB on the savings of an individual. This study’s findings revealed that price fluctuation, price differential, and spending hurt the individual saving rate.
4	Arafat <i>et al</i> <sup>[2]</sup>	2020	Original	Responsible factors of panic buying: An observation from online media reports	Analysis of media reports	The authors analyzed 784 media reports to find out the reported responsible factors of panic buying. A sense of scarcity, increased demand, importance of the product, and anticipation of the price hike were the major contributing force towards PB, as mentioned in the reports. The authors postulated a causative model of PB.
5	Arafat <i>et al</i> <sup>[3]</sup>	2020	Original	Media portrayal of panic buying: A content analysis of online news portals	Analysis of media reports	This study analyzed content published in media to determine how media is depicting PB during COVID-19. The findings suggested that the media have been portraying more negative aspects of PB. The authors recommended developing media guidelines to censor news that influences impulse buying behavior.
6	Arafat <i>et al</i> <sup>[4]</sup>	2020	Original	Panic buying: An insight from the content analysis of media reports during COVID-19 pandemic	Media report analysis	The authors proposed a definition of PB. This study analyzed information extracted from English media reports to evaluate the nature, extent, and impact of PB.
7	Arafat <i>et al</i> <sup>[5]</sup>	2020	Correspondence	Psychological underpinning of panic buying during pandemic (COVID-19)		The authors studied psychological reasons of PB, which include fear of scarcity, insecurity, losing control over the environment, social learning, and exacerbation of anxiety.
8	Arafat <i>et al</i> <sup>[6]</sup>	2020	Correspondence	Possible controlling measures of panic buying during COVID-19		The authors mentioned possible measures to control PB during a pandemic. The recommendations included positive role-playing by media. Promotion of feeling of kinship and encouraging generosity can reduce it from the public end. Setting a quota policy and subsidiary sales for necessity items could be a potential strategy.
9	Arafat <i>et al</i> <sup>[9]</sup>	2020	Correspondence	Panic buying: Is it really a problem?		The paper mentioned some challenges to study PB in detail to explore its several aspects
10	Benker <sup>[13]</sup>	2020	Original	Stockpiling as resilience: Defending and contextualising extra food procurement during lockdown	Online interview	This study analyzed 19 invited interviews taken online in the United Kingdom. The study found that though food shortages were common for a couple of weeks, food hoarding didn’t make impulsive buying. The United Kingdom households considered food procurement as a single resilience strategy among the taken six strategies.
11	Chen <i>et al</i> <sup>[14]</sup>	2020	Discussion	A discussion of irrational stockpiling behaviour during crisis		The authors discussed the current and long-term impact of PB on the economy, society, and local communities. They think that stopping impulse buying is impossible, but it should be controlled by improving the supply chain and maintaining communication with the stakeholders.
12	Dammeyer <sup>[15]</sup>	2020	Original	An explorative study of the individual differences associated with consumer stockpiling during the early stages of the 2020 Coronavirus outbreak in Europe	Online survey	This study answered whether individual differences influenced PB during crises. The authors found a high tendency of stockpiling on extroversion and neuroticism and a relatively low tendency on conscientiousness and openness.

13	Dickins <i>et al</i> <sup>[16]</sup>	2020	Original	Food shopping under risk and uncertainty	Authors analyzed super market sales data	In this study, the authors showed the importance of food security and suggested optimality models of foraging under risk and uncertainty as foraging correlates to PB.
14	Dulam <i>et al</i> <sup>[17]</sup>	2020	Original	Development of an agent-based model for the analysis of the effect of consumer panic buying on supply chain disruption due to a disaster	Simulation model	This study used an agent-based simulation model to analyze how a supply chain responds to consumer PB caused by a natural disaster. The authors found this model useful in applying a quota policy per person to protect the supply chain from disruption.
15	Du <i>et al</i> <sup>[18]</sup>	2020	Original	COVID-19 increases online searches for emotional and health-related terms	Data mining from Google Trends	This study measured fear-related emotions, protective behaviors, seeking health-related knowledge, and PB due to COVID-19 prevalence in the United States, the United Kingdom, Canada, and Australia using internet search volumes in Google Trends. The results found that the increased prevalence of COVID-19 was associated with panic buying consistently in all four countries.
16	Hall <i>et al</i> <sup>[19]</sup>	2020	Original	Beyond panic buying: consumption displacement and COVID-19	Cross-sectional	The authors analyzed consumer spending data acquired from financial third parties and found instances of PB for grocery, home, hardware, and electrical categories that happened in the Canterbury region of New Zealand before the lockdown that lasted less than a week. The study showed a high consumption displacement in the hospitality and retailing sectors that dominate this area's economy.
17	Hao <i>et al</i> <sup>[20]</sup>	2020	Original	Impact of online grocery shopping on stockpile behavior in COVID-19	Online survey	It investigated how online shops affect the food stockpiling manner among urban consumers in China using bivariate probit models. The authors recommended improved and resilient supply chains that can withstand intense PB phenomena during emergencies.
18	Islam <i>et al</i> <sup>[21]</sup>	2020	Original	Panic buying in the COVID-19 pandemic: A multi-country examination	Online survey	The authors surveyed 1081 people from United States, China, India, and Pakistan to test their conceptual model and hypotheses. The research revealed that stimuli such as Limited Quantity Scarcity and Limited Time Scarcity affect emotional stress, which eventually influences impulse buying. The findings also correlated excessive social media use to PB and discussed some managerial implications.
19	Jeżewska-Zychowicz <i>et al</i> <sup>[22]</sup>	2020	Original	Consumers' fears regarding food availability and purchasing behaviors during the COVID-19 pandemic: The importance of trust and perceived stress	Cross-sectional	It investigated how the public perception of food availability changed based on the trust in the received information from media and friends. The participants showed less trust in media for COVID updates but high trust in media and friends for food availability updates and increased buying more food than usual. The consumers were highly afraid of empty shelves in the market, which also motivated them to stockpile food.
20	Kar <i>et al</i> <sup>[23]</sup>	2020	Correspondence	Online group cognitive behavioral therapy for panic buying: Understanding the usefulness in COVID-19 context		The authors postulated to explain the usefulness of online group CBT in COVID19 context for controlling the PB.
21	Keane <i>et al</i> <sup>[24]</sup>	2020	Original	Consumer panic in the COVID-19 pandemic	Data mining using Google Health Trends API	The authors developed an econometric model of consumer panic using Google search data for 54 countries from January 1 <sup>st</sup> to April 30 <sup>th</sup> , 2020. Findings included limited movement notice announced by local or foreign governments generated a week-long short-run panic. The study found little impact of stimulus offerings and no consumer panic due to travel restrictions.
22	Kostev <i>et al</i> <sup>[25]</sup>	2020	Original	Panic buying, or good adherence? Increased pharmacy purchases of drugs from wholesalers in the last week before Covid-19 lockdown	Retrospective cross-sectional analysis of the IMS RPM® (Regional Pharmaceutical Market) Weekly database	The paper assessed the PB of medication during the COVID-19 pandemic in Germany. The study suggested that Germany's lockdown was associated with a sharp increase in purchasing behavior in pharmacies for different markets, including psychotropic, neurological, and cardiovascular drugs.
23	Laato <i>et al</i> <sup>[26]</sup>	2020	Original	Unusual purchasing behavior during the early stages of the COVID-19 pandemic: The stimulus-organism-response approach	Online survey	The authors conducted a web survey with 211 Finnish participants for a week to test a hypothetical research model. The study found a positive link between voluntary self-isolation and unusual purchases. The online information overload caused cyberchondria, which eventually motivated self-isolation followed by PB.
24	Lins <i>et al</i> <sup>[27]</sup>	2020	Original	Development and initial psychometric properties of a panic buying scale during COVID-19 pandemic	Online survey	This study developed the first PB scale that was psychometrically acceptable in the Brazilian context.



25	Loxton <i>et al</i> <sup>[28]</sup>	2020	Review	Consumer behavior during crises: Preliminary research on how coronavirus has manifested consumer panic buying, herd mentality, changing discretionary spending and the role of the media in influencing behaviour	Literature review and cross-sectional data analysis	This study reviewed consumer behavior data, including impulse buying, herd instinct, and prioritization of purchasing decisions of past crises and shock events. The authors then analyzed consumer spending data acquired from data services that confirmed the sorted variables in the COVID-19 context.
26	Martin-Neuninger <i>et al</i> <sup>[29]</sup>	2020	Opinion	What does food retail research tell us about the implications of coronavirus (COVID-19) for grocery purchasing habits?		The paper discussed the consequences of lockdowns on consumer grocery purchasing habits, focusing on New Zealand. In avoidance of PB, the authors suggested few recommendations to the food companies so that people can enjoy visiting supermarkets without compromising safety. They also asked to improve online delivery services to gain trust and customer confidence.
27	Micalizzi <i>et al</i> <sup>[1]</sup>	2020	Original	Stockpiling in the time of COVID-19	Survey	This study aimed to discuss stockpiling behavior during COVID-19 and investigated individual predictors of stockpiling. Those affiliated with conservative politics, worry much about COVID-19, and self-isolated were prone to stockpiling behavior.
28	Naeem <sup>[30]</sup>	2020	Original	Do social media platforms develop consumer panic buying during the fear of Covid-19 pandemic	Telephonic interview	The study revealed how social media aggravated PB by arousing fear appeal. Along with some exacerbating factors like uncertainties, anxiety, persuasive buying, empty shelves, and exert opinion, a huge load of information at users' fingertips made them more anxious about what was to come, leading to panic buying.
29	Prentice <i>et al</i> <sup>[31]</sup>	2020	Original	Timed intervention in COVID-19 and panic buying	Semantic analysis, secondary data and big data analysis	This paper depicted PB as a side effect of the Australian government's timed-intervention policy. The authors supported their findings with real-life evidence.
30	Rosita <sup>[32]</sup>	2020	Review	Panic buying in the COVID-19 pandemic era in Indonesia	Literature review	This paper proposed a definition of PB and extrapolated some underlying reasons for it. It also mentioned the negative impact of impulsive buying and recommended some stakeholders' measures to control it.
31	Shorey <i>et al</i> <sup>[33]</sup>	2020	Original	Perceptions of the public on the COVID-19 outbreak in Singapore: A qualitative content analysis	Qualitative content analysis	This study analyzed 2075 comments made to the 29 published news by local media outlets on their Facebook pages to find common concerns shared by Singapore's public. The five main themes derived from the qualitative thematic analysis were fear and concern, PB and hoarding, reality and expectations about the situation, staying positive amid the 'storm,' and worries about the future. The authors recommended clear communication, timely updates, and support measures from the government to maintain social peace and cohesion.
32	Sim <i>et al</i> <sup>[6]</sup>	2020	Correspondence	The anatomy of panic buying related to the current COVID-19 pandemic		The paper mentioned two episodes of PB in Singapore due to a new alert level set by the local authority and the declaration of COVID-19 as a pandemic by the World Health Organization. The authors found some underlying reasons for PB and suggested some recommendations to facilitate it.
33	Singh <i>et al</i> <sup>[34]</sup>	2020	Commentary	A critical analysis to comprehend panic buying behaviour of Mumbaikar'sin COVID-19 era		The authors studied different driving factors of PB and suggested how the retailers should adapt inventory when the supply chain is under disruption. They recommended stopping the panic buying so that others can get the share of the products.
34	Turambi <i>et al</i> <sup>[35]</sup>	2020	Original	Panic buying perception in Waliansatu sub-district, Tomohon City	Online survey	This study analyzed the perception of city dwellers towards PB due to COVID-19. It described different PB episodes that appeared in a city in Indonesia.
35	Yuen <i>et al</i> <sup>[7]</sup>	2020	Review	The psychological causes of panic buying following a health crisis	Systematic review	It was the first systematic review on PB. The authors identified four major themes responsible for PB.
36	Zheng <i>et al</i> <sup>[36]</sup>	2020	Original	Supply disruption management under consumer panic buying and social learning effects	Analytical study	The study analyzed how social learning among customers can influence buying decisions when adequate supply is at risk. When the panic intensity is at a moderate level, social learning can help to adjust the consumer demand, but it will work negatively when the panic intensity is very low or very high. The authors also introduced an optimal inventory ordering strategy for retailers.
37	Tsao <i>et al</i> <sup>[37]</sup>	2019	Original	Product substitution in different weights and brands considering customer segmentation and	Mathematical model	It proposed a mathematical model for managing wholesaler's inventory to maximize the profit during PB. The authors suggested substituting the same products of different weights and brands between high- and

				panic buying behavior		low-indexed stores during a supply disruption. The model can determine optimal order quantity, the number of substitutable units, leftover units, and the unsated demand to improve the store services.
38	Wei <i>et al</i> <sup>[38]</sup>	2011	Original	Research on emergency information management based on the social network analysis — A case analysis of panic buying of salt	Data mining	This research studied how to manage information in an emergency analyzing social network to control PB.
39	Fung <i>et al</i> <sup>[39]</sup>	2010	Original	Disaster preparedness of families with young children in Hong Kong	Survey	This study surveyed households' heads to explore their perception and preparedness for future disastrous events most likely to occur in Hong Kong. These families experienced PB for necessities during disasters especially for children's items and drugs.
40	Kulemeka <sup>[40]</sup>	2010	Commentary	United States consumers and disaster: Observing "panic buying" during the winter storm and hurricane seasons		This article was an update of ongoing research. This article narrated predisaster shopping and claimed that such shoppers do not go for panic buying rather help each other.
41	Bonneux <i>et al</i> <sup>[41]</sup>	2006	Correspondence	An iatrogenic pandemic of panic		The authors mentioned humans' overreactions to the perceived threat of a hypothetical pandemic accompanied by clever marketing for the panic buying of antiviral drugs.
42	Thomas <sup>[42]</sup>	2002	Editorial	Panic buying ahead?		The author highlighted the preparedness for future PB influenced by herd instinct in the semiconductor industry.

CBT: Cognitive behavior therapy; COVID-19: Coronavirus disease 2019; PB: Panic buying.

### Reported aspects of PB

Definition of PB, causative model, econometric model, media reporting of PB, responsible factors for PB, psychological reasons for PB, controlling strategy, measuring instrument, challenges to explore the problem, and geographical distribution have been identified.

### Academic domains

Several domains have been researched such as psychology, supply chain, management, disaster preparedness, e-commerce, consumer behavior, marketing, prevention strategies, media, social network, economics, personality, and engineering (Table 2).

### Distribution of authors

Authors from several disciplines, such as psychiatry, management, economics, business, sales and marketing, consumer behavior, public health, communication, information management, sociology, engineering, business administration, psychology, nursing, health economics, food policy, epidemiology, and community health, have been studied it. Most of the authors were affiliated with institutions from Australia, Bangladesh, China, India, Singapore, and the United States (Table 2). Eighteen papers had cross-country collaboration, and ten were funded projects. The average number of authors per paper was 3.3; Arafat SMY has published the maximum number of papers (6) as the first author on the topic.

Table 2 Bibliometric summary of the articles

Ref.	Author No.	Month of publication	Country of the 1 <sup>st</sup> author	Country of the corresponding author	Specialty of the 1 <sup>st</sup> author	Specialty of the corresponding author	Collaboration	Journal	Subject of the journal	Domain of the discussed topic	Funding
Ahmed <i>et al</i> <sup>[10]</sup>	4	Aug 20	Pakistan	Pakistan	Sales and Marketing	Sales and Marketing	Cross-country	<i>J of Competitiveness</i>	Competitiveness	Impulse buying behavior	No info
Alchin <sup>[11]</sup>	1	Jul 20	Australia	Australia	Public health	Public health		<i>Australasian Psychiatry</i>	Psychiatry	Panic buying during disaster	No funding
Alfa <i>et al</i> <sup>[12]</sup>	2	Sep 20	Nigeria	Nigeria	Economics	Economics	Intracountry	<i>Lapai J of Economics</i>	Economics	Economics	No info
Arafat <i>et al</i> <sup>[2]</sup>	7	Nov 20	Bangladesh	Bangladesh	Psychiatry	Psychiatry	Cross-country	<i>Frontiers in Public Health</i>	Public health	Media	No funding
Arafat <i>et al</i> <sup>[3]</sup>	9	Sep 20	Bangladesh	Bangladesh	Psychiatry	Psychiatry	Cross-country	<i>Global Psychiatry</i>	Psychiatry	Media	No funding
Arafat <i>et al</i> <sup>[4]</sup>	9	Jul 20	Bangladesh	Bangladesh	Psychiatry	Psychiatry	Cross-country	<i>Neurology, Psychiatry and Brain Research</i>	Psychiatry	Media	No funding
Arafat <i>et al</i> <sup>[5]</sup>	6	May 20	Bangladesh	Bangladesh	Psychiatry	Psychiatry	Cross-country	<i>Psychiatry Research</i>	Psychiatry	Psychological causes of panic buying	No funding
Arafat <i>et al</i> <sup>[8]</sup>	3	May 20	Bangladesh	Bangladesh	Psychiatry	Psychiatry	Cross-country	<i>Int J of Mental Health and Addiction</i>	Psychiatry	Controlling of panic buying	No funding
Arafat <i>et al</i> <sup>[9]</sup>	3	Sep 20	Bangladesh	India	Psychiatry	Psychiatry	Cross-country	<i>Int J of Social Psychiatry</i>	Psychiatry	Challenges of scientific studying	No funding
Benker <sup>[13]</sup>	1	Oct 20	United Kingdom	United Kingdom	Sociology	Sociology		<i>Appetite</i>	Behavioral science	Emergency preparedness	No funding
Chen <i>et al</i> <sup>[14]</sup>	7	Jun 20	Australia	Australia	Engineering	Engineering	Intracountry	<i>J of Safety Science and Resilience</i>	Disaster	Economics	No funding
Dammeyer <sup>[15]</sup>	1	Jul 20	Denmark	Denmark	Psychology	Psychology		<i>Personality and Individual Differences</i>	Psychology	Individual personality and PB	No funding
Dickins <i>et al</i> <sup>[16]</sup>	2	Oct 20	United Kingdom	United Kingdom	Psychology	Psychology	Intracountry	<i>Learning and Motivation</i>	Psychology	Uncertainty and PB	No funding
Dulam <i>et al</i> <sup>[17]</sup>	3	Apr 20	Japan	Japan	Engineering	Engineering	Intracountry	<i>J of Advanced Simulation in Science and Engineering</i>	Engineering	Technology and PB	No info
Du <i>et al</i> <sup>[18]</sup>	4	Oct 20	China	China	Psychology	Psychology	Intracountry	<i>Applied Psychology: Health and Well-Being</i>	Psychology	Behavioral perspectives	National Natural Science Foundation of China
Hall <i>et al</i> <sup>[19]</sup>	4	Jul 20	New Zealand	New Zealand	Management	Management	Cross-country	<i>J of Service Management</i>	Management	Consumer behavior during a disaster	No info
Hao <i>et al</i> <sup>[20]</sup>	3	Aug 20	China	China	Economics	Economics	Cross-country	<i>China Agricultural</i>	Economics	E-commerce's role	Beijing Municipal

								<i>Economic Review</i>		on food hoarding	Education Commission Social Science
Islam et al <sup>[21]</sup>	7	Oct 20	China	China	Economics and Management	Economics and Management	Cross-country	<i>J of Retailing and Consumer Services</i>	Marketing	Reasons of panic buying	National Social Science Fund of China
Jeżewska-Zychowicz et al <sup>[22]</sup>	3	Sep 20	Poland	Poland	Business	Business	Intracountry	<i>Nutrients</i>	Human nutrition	Behavioral perspectives	Warsaw university of life sciences
Kar et al <sup>[23]</sup>	3	Oct 20	India	India	Psychiatry	Psychiatry	Cross-country	<i>Indian J of Psychiatry</i>	Psychiatry	Behavioral perspectives for Controlling of panic buying	No funding
Keane et al <sup>[24]</sup>	2	Aug 20	Australia	Australia	Health Economics and Marketing	Consumer Behaviour, Econometrics	Intracountry	<i>J of Econometrics</i>	Econometrics	Econometrics model of PB	Australian Research Council grants
Kostev et al <sup>[25]</sup>	2	Jul 20	Germany	Germany	Epidemiology, public health	Epidemiology, public health	Intracountry	<i>J of Psychiatric Research</i>	Psychiatry	Drug purchasing surge during COVID 19	No funding
Laato et al <sup>[26]</sup>	4	Jul 20	Finland	Norway	Technologies	Economics and management	Cross-country	<i>J of Retailing and Consumer Services</i>	Marketing	Media and panic buying	No info
Lins et al <sup>[27]</sup>	2	Sep 20	Portugal	Portugal	Social psychology	Social psychology	Cross-country	<i>Heliyon</i>	Medical sciences	Measurement instrument	No funding
Loxton et al <sup>[28]</sup>	6	Jul 20	Australia	China	Business	Economics	Cross-country	<i>J of Risk and Financial Management</i>	Finance and Risk	Consumer behavior during disasters	No funding
Martin-Neuninger et al <sup>[29]</sup>	2	Jun 20	New Zealand	New Zealand	Food Policy and Security	Food Policy and Security	Cross-country	<i>Frontiers in Psychology</i>	Psychology	Consumer behaviour	No funding
Micalizzi et al <sup>[1]</sup>	3	Oct 20	United States	United States	Behavioral and Social Sciences	Behavioral and Social Sciences	Intracountry	<i>British J of Health Psychology</i>	Psychology	Hoarding during emergency	National Institutes on Drug Abuse
Naeem <sup>[30]</sup>	1	Sep 20	United Kingdom	United Kingdom	Business administration	Business administration		<i>J of Retailing and Consumer Services</i>	Marketing	Social media and panic buying	No funding
Prentice et al <sup>[31]</sup>	3	Aug 20	Australia	Australia	Marketing and Consumer Behavior	Marketing and Consumer Behavior	Intracountry	<i>J of Retailing and Consumer Services</i>	Marketing	Government timed-intervention policy and PB	Inspector General Emergency Management Queensland, Australia
Rosita <sup>[32]</sup>	1	Oct 20	Indonesia	Indonesia	Consumer behavior	Consumer behavior		<i>Int J of Multiscience</i>	All disciplines	Consumer behavior	No info
Shorey et al <sup>[33]</sup>	4	Jul 20	Singapore	Singapore	Nursing	Nursing	Intracountry	<i>Journal of Public Health</i>	Public health	Responses during emergencies	No funding

Sim <i>et al</i> <sup>[6]</sup>	4	Apr 20	Singapore	Singapore	Psychiatry	Psychiatry	Cross-country	<i>Psychiatry Research</i>	Psychiatry	Panic buying distribution	No info
Singh <i>et al</i> <sup>[34]</sup>	2	Mar 20	India	India	Arts humanities & communication	Arts humanities & communication	Intracountry	<i>Studies in Indian Place Names</i>	History	Supply chain	No info
Turambi <i>et al</i> <sup>[35]</sup>	2	No info	Indonesia	Indonesia	Economics	Economics	Intracountry	<i>International Journal of Applied Business and International Management</i>	Business	Behavioral perspectives	No info
Yuen <i>et al</i> <sup>[7]</sup>	4	May 20	Singapore	China	Economics and Supply Chain Management	Economics and Supply Chain Management	Cross-country	<i>Int J Environ Res Public Health</i>	Environmental and Public Health	Psychological causes of panic buying	Nanyang Technological University, Singapore
Zheng <i>et al</i> <sup>[36]</sup>	3	Mar 20	China	Hong Kong	Management	Management	Cross-country	<i>Omega</i>	Management	Supply chain	Hongkong & China
Tsao <i>et al</i> <sup>[37]</sup>	3	Feb 19	Taiwan	Taiwan	Industrial management	Industrial management	Intracountry	<i>Industrial Marketing Management</i>	Industrial marketing	Marketing and supply chain	Partially supported by Ministry of Sci and Tech Taiwan
Wei <i>et al</i> <sup>[38]</sup>	3	Sep 11	China	China	Information management	Information management	Intracountry	2011 International Conference on Management Science & Engineering (18 <sup>th</sup> )	Management Science and Engineering	Social network data mining and PB	No info
Fung <i>et al</i> <sup>[39]</sup>	2	Sep 10	Hong Kong	Hong Kong	Family and Community Health	Family and Community Health	Intracountry	<i>Scandinavian J of Public Health</i>	Public health	Disaster preparedness	No funding
Kulemeko <sup>[40]</sup>	1	No info	United States	United States	Business and Economics	Business and Economics		<i>Advances in Consumer Research</i>	Consumer research	Disaster preparedness	No info
Bonneux <i>et al</i> <sup>[41]</sup>	2	Mar 06	Belgium	Belgium	Public health	Public health	Intracountry	<i>BMJ</i>	Medical sciences	Drug stockpiling	No info
Thomas <sup>[42]</sup>	1	Aug 02	No info		Semiconductor			<i>III-Vs Review</i>	Semiconductor industry	Possible pb in semiconductor industry	No info

### Distribution of journals

The maximum number of papers were published in behavioral health (13: Psychiatry 9; psychology 4), followed by business (including marketing and management) (12), public health (4), and economics (3) (Table 2). *Journal of Retailing and Consumer Services* hosted the maximum number of papers on PB (4) followed by *Psychiatry Research* (2).

### Distribution of keywords

A wide spectrum of keywords was found in articles with a prominence of COVID-19, PB, Coronavirus, and pandemic. Figure 2 shows the word cloud analysis of different keywords extracted from research publications on “panic buying.” Words with a larger font size refer to the most frequently used keywords and vice versa. Different colors are used to differentiate words from each other. Colors do not have any



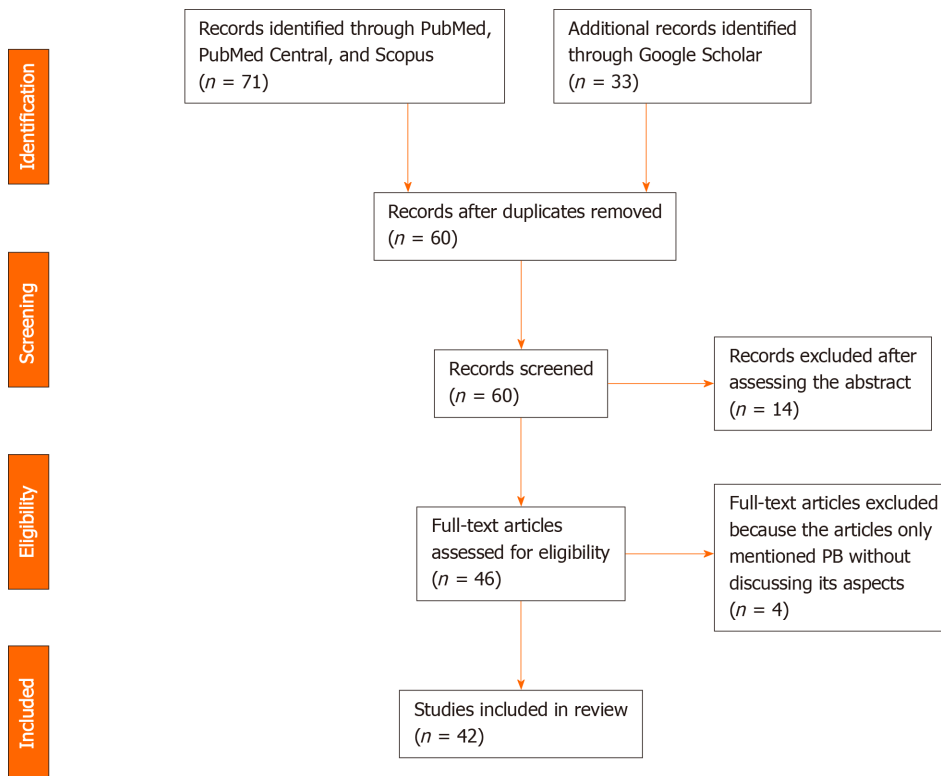


Figure 1 Preferred reporting items for systematic reviews and meta-analyses flow diagram.

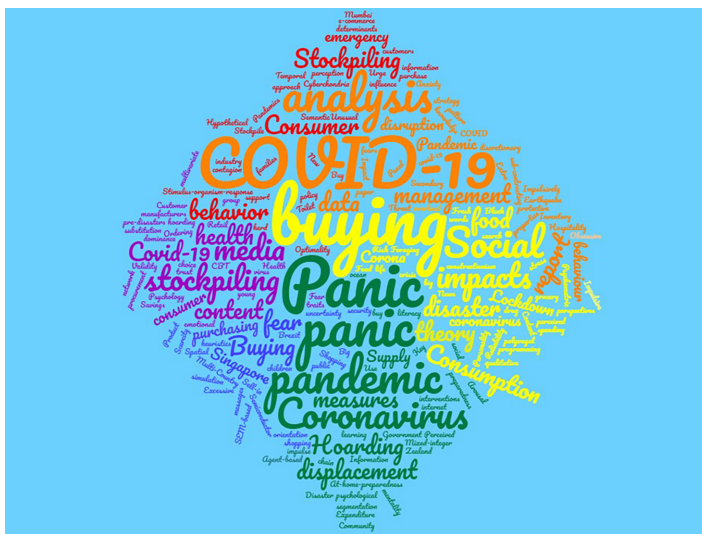


Figure 2 Word cloud analysis of key words. The color of the words does not have any significance.

statistical significance.

## DISCUSSION

We aimed to identify the aspects of PB already explored and research trends. We searched PubMed, PMC, Scopus, and GS with the search term “panic buying” on November 15, 2020. A total of 42 articles were collected and scrutinized (Figure 1). The type of research, publishing year, applied method, key findings, geographical distribution of the authors, specialty of authors, collaboration, subject of the journal, and research funding were assessed (Table 1 and Table 2).

### **Main findings**

The main findings of the review revealed that some aspects of PB have been addressed such as the definition of PB<sup>[4]</sup>, causative model<sup>[2]</sup>, econometric model<sup>[21]</sup>, media reporting of PB<sup>[3]</sup>, responsible factors for PB<sup>[2]</sup>, psychological reasons for PB<sup>[5-7]</sup>, controlling strategy<sup>[8]</sup>, measuring instrument<sup>[27]</sup>, challenges to explore PB<sup>[9]</sup>, and geographical distribution<sup>[2]</sup>. However, the methods were superficial that instigated further studies to replicate the observations.

### **Distribution of the studies**

The study revealed that more than three-quarters (85.71%) of the research output on PB has occurred in the wake of the COVID-19 pandemic. This is an indication of the growing public health relevance of this phenomenon. More than sixty percent (64.28%) of the papers were original contributions indicating that the more empirical studies are coming out gradually (Table 1). Most of the studies applied survey and cross-sectional study design, which may be explained by the pattern of PB as it appears irregularly, episodically, and erratically in response to the adverse stimuli<sup>[2,9]</sup>. However, longitudinal studies are better in order to explore the behavior. Online media reports, social media, and Google Trends were also used, which may be explained by the COVID-19 pandemic, and the lockdown was applied.

### **Responsible factors**

Several studies have looked at the etiological underpinnings of PB, mainly in terms of psychological and social factors that may contribute to the phenomenon<sup>[5-7]</sup>. The results are intuitive and point to the significance of perception of commodity and time scarcity, sense of uncertainty as well as the herd instinct, which has its basis in the social learning theory, as potential contributors to the genesis of PB<sup>[2,5-7]</sup>. Further, perceptions of price differential and price fluctuations have been found to correlate with PB behavior; this has implications from a management perspective and highlights the importance of maintaining supply chains.

### **Controlling measures of PB**

Little empirical evidence is available on the management of PB. One group of authors proposed an online cognitive behavior therapy model for PB, but it was not tested<sup>[23]</sup>. The media should play a central role in curbing PB by spreading awareness about the phenomenon and adopting responsible reporting practices. A collaborative approach between the media, government, and health sector would foster a collective sense of responsibility and bring about sustainable changes in reporting practices, a key strategy to control PB<sup>[3]</sup>.

Drawing upon these insights, it appears that PB can be controlled by adequate, timely, and consistent information on the evolving situation with an additional focus on clarifying misinformation or rumors. To reduce visual cues, big retail stores can encourage online shopping at least for those who are young/internet savvy. This will reduce long queues outside shopping stores, which is a visual signal for other buyers to join, and will reduce the possibility of such images being circulated in the mass media and social media, another important cue for PB<sup>[10]</sup>. Opening fair price shops where commodity prices are tightly regulated may be helpful in curbing panic purchases.

### **Academic domains**

Researchers from several specialties took part in PB research, multiple academic domains have been researched, and articles have been published in several specialty journals such as psychiatry, psychology, business, sales and marketing, public health, supply chain, economics, management, consumer behavior, disaster preparedness, e-commerce, consumer behavior, marketing, prevention strategies, media, social network, economics, communication, information management, sociology, personality, nursing, health economics, food policy, epidemiology, community health, and engineering (Table 2). Consumer behavior patterns have been studied during different situations such as pandemic<sup>[28]</sup> and seasonally recurring disasters<sup>[40]</sup>. Insights from these studies can be used to spread awareness about PB, facilitate the identification of hoarders, and take steps to mitigate supply chain disruptions<sup>[37]</sup>. Reducing conflicting information from different media sources and giving advance information about impending seasonal disasters would assist people in staggering their purchases and reduce eleventh-hour PB. Concordance of information from media sources is likely to promote trust in the media, a key element that has been linked to an increased likelihood of distress purchases<sup>[22]</sup>.

**Distribution of authors**

Most of the authors were affiliated with institutions from Australia, Bangladesh, China, India, Singapore, and the United States (Table 2). The fact that more than half of the studies reviewed originated from Asia may reflect the proneness of countries in the region for PB, probably due to a combination of structural issues, public mistrust, and lack of adequate governmental action. More than forty percent (42.85%) of the papers had intercountry collaborations signifying the common interest of the research. Among the 10 funded projects, China had the highest funding (3 full; 1 partial); Australia (2), Hong Kong (1 partial), United States (1), Poland (1), Taiwan (1), and Singapore (1).

**Strengths of the study**

This is the first systematic approach to provide an overview and identify the research gaps on the emerging research topic. Only peer-reviewed published articles were reviewed.

**Limitations**

The search was done cross-sectionally by a single individual (first author). Only articles published in the English language were included. Preprints were not included.

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**CONCLUSION**

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PB is a relatively newer concept to get the attention of the research community. The study revealed several important aspects of PB research including research trends, major studied areas, geography, collaboration, and funding of studies. This review would help policymakers, researchers, funders, and other stakeholders to shape their decision while studying PB. Further robust studies with replication of the findings are warranted to fill the research gaps identified in this review.

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**ARTICLE HIGHLIGHTS**

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**Research background**

Panic buying is an under-addressed research entity.

**Research motivation**

Sporadic evidence is coming out in recent days.

**Research objectives**

We aimed to see the perspectives of panic buying that have been studied through November 15, 2020.

**Research methods**

We did a systematic search in PubMed, PubMed Central, Scopus, and Google Scholar and reviewed 42 articles.

**Research results**

The study identified the distribution of study, aspects of panic buying, academic domain related to panic buying, distribution of authors, the specialty of the authors and journals, funding, and collaborations of the identified articles.

**Research conclusions**

Although the study identified some important perspectives, further studies are warranted in a systematic manner.

**Research perspectives**

The review provides a good insight into the different stakeholders to plan further studies and prevent panic buying.

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