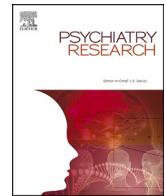




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# Why did all the toilet paper disappear? Distinguishing between panic buying and hoarding during COVID-19

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## ABSTRACT

The COVID-19 pandemic led to panic buying in many countries across the globe, preventing vulnerable groups from accessing important necessities. Some reports inaccurately referred to the panic buying as hoarding. Although hoarding is a separate issue characterised by extreme saving behaviour, the two problems may be influenced by similar factors. Participants from Australia and the United States (final  $N = 359$ ) completed online self-report measures of panic buying, hoarding, shopping patterns, perceived scarcity, COVID-19 illness anxiety, selfishness, and intolerance of uncertainty. Our findings showed that panic buying was related to hoarding symptoms ( $r$ 's = .23 - .36), and yet, both were uniquely associated with different psychological factors. Whilst panic buying was most strongly related to greater perceived scarcity ( $r$ 's = .38 - .60), hoarding was most related to a general intolerance of uncertainty ( $r$ 's = .24 - .57). Based on our findings, future strategies to prevent panic buying should focus on reducing perceived scarcity cues in the community, as this seems to be the primary driver of panic buying. Another preventative strategy to reduce excessive acquiring and saving may be to implement educational programs to increase people's ability to tolerate distress and uncertainty.

## 1. Introduction

On 11th March 2020, the World Health Organisation declared COVID-19 a pandemic (WHO, 2020), and at that same time, widespread panic buying left many supermarket shelves emptied. Although some of the measures taken to prevent the spread of COVID-19 infections (e.g., quarantines, lockdowns, and social distancing) were expected to increase the amount of goods purchased, consumers purchased much more than was needed to make-up for the products they would use outside of the home (Hall et al., 2020; Hobbs, 2020). This led retailers in many countries around the world to limit the number of certain items that could be purchased, thereby prohibiting customers from buying more than was necessary (Ziady, 2020). The extreme nature of some individuals' panic buying led many to refer to the behaviour as hoarding (e.g., Kirk and Rifkin, 2020; Oosterhoff and Palmer, 2020; Sheth, 2020); however, these issues are separate (Norberg and Rucker, 2020). Panic buying involves the *purchasing* of large amounts of consumer goods in response to a perceived threat or disaster (Yuen et al., 2020), whereas hoarding is more chronic and involves the *saving* of possessions that are perceived as needed, so much so that a person's home becomes substantially cluttered and disorganised (American Psychiatric Association,

2013). The COVID-19 pandemic and spread of fear through social media and the Internet may have exacerbated both issues (Ahmad and Murad, 2020; Islam et al., 2020; Kim et al., 2020; Laato et al., 2020; Naem, 2021; Sim et al., 2020). We aimed to understand if buying restrictions were perceived to be helpful and which psychological factors were associated with panic buying and hoarding during the pandemic, to learn how to manage these behaviours during future calamitous events.

The degree to which an individual perceives the threat or scarcity of a product is an important determinant of panic buying behaviour (Yuen et al., 2020). For example, recent surveys assessing individuals from the US, China, India, and Pakistan found that greater perception of the risk and severity of COVID-19, greater news monitoring, and perceived scarcity were associated with more panic buying (Clemens et al., 2020; Islam et al., 2020; Oosterhoff and Palmer, 2020; Zhang and Zhou, 2021). Further, when others are seen to panic buy, this may intensify the perceived scarcity of a product and increase the motivation to panic buy, resulting in herd behaviour (Badddeley, 2010; Loxton et al., 2020; Zheng et al., 2020). According to the self-regulatory model of resource scarcity, individuals may respond to perceived scarcity by either collecting resources or regaining control in another way (Cannon et al., 2019). In line with this model, researchers have found that when products are

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perceived to be scarce, consumers are more motivated to stockpile (Aggarwal et al., 2011; Yangui and Hajtaieb El Aoud, 2015).

Although the perception of a threat or scarcity is important, the degree to which an individual feels they can manage the threat may also influence panic buying behaviour (Arafat et al., 2020; Yuen et al., 2020). Environmental threats, such as COVID-19, introduce uncertainty into people's lives, and some individuals may find it harder than others to tolerate the distress and anxiety associated with uncertainty (Freeston et al., 2020). This may lead to a greater perceived severity of threat. For example, research on the 2009 swine flu pandemic showed that higher intolerance of uncertainty was related to greater swine flu-related anxiety and a greater perceived severity of the pandemic (Taha et al., 2014). A recent study examining adults from the UK and Ireland found that greater levels of COVID-19-related anxiety and intolerance of uncertainty were associated with over-purchasing common products such as toilet paper and tinned foods (Bentall et al., 2021).

Similarly, individuals with hoarding problems save excessive amounts of possessions to cope with uncertainty and life stressors (e.g., Landau et al., 2011; Timpano et al., 2011); thus, the uncertainty and stress of the COVID-19 pandemic may have made existing hoarding problems worse. A large amount of research has linked hoarding problems to intolerance of uncertainty and distress (e.g., Grisham et al., 2018; Mathes et al., 2017; Norberg et al., 2020; Norberg et al., 2015; Shaw and Timpano, 2016). Recent research has shown that, in the general public, the COVID-19 pandemic is associated with greater levels of psychological distress and a range of psychopathological problems such as depression, anxiety, and post-traumatic stress symptoms (e.g., Gao et al., 2020; Qiu et al., 2020; Wang et al., 2020). Public health measures such as lockdowns and social distancing may have introduced additional interpersonal stressors, which are also strongly associated with hoarding (e.g., David et al., 2021; Grisham et al., 2018; Norberg et al., 2020). Thus, it is likely that the social and emotional effects of COVID-19 may have contributed to hoarding problems.

Panic buying and hoarding may be evolutionarily adaptive responses to scarcity and uncertainty, as securing resources can help individuals survive (Grisham and Barlow, 2005; Leach, 1994); however, they are also self-interested responses. Panic buying can be interpreted as selfish when it prevents others from accessing products. Some who engaged in panic buying may have realised that their behaviour prevented others from accessing important necessities but did it anyway. Oosterhoff and Palmer (2020) found evidence that panic buying during COVID-19 was related to greater self-interested values and feeling less responsible for others. Similarly, hoarding can also be viewed as selfish, especially by family members who believe their loved one places more importance on their possessions rather than them (e.g., Wilbram et al., 2008). Previous research has found associations between hoarding and self-reported domineering and vindictive behaviours (Grisham et al., 2008; Norberg, Kwok, et al., 2020), which are correlates of selfishness (Kaufman and Jauk, 2020). Thus, in response to perceived scarcities associated with COVID-19, those with greater trait selfishness may have been more likely to engage in panic buying and hoarding.

Individuals with pre-COVID-19 hoarding problems may have engaged in panic buying more so than individuals without pre-existing hoarding problems. Although not a core feature, the majority (at least 85%) of individuals with hoarding disorder engage in excessive acquisition (Frost et al., 2013; Frost et al., 2009; Timpano, Exner et al., 2011) and those who excessively acquire have greater saving tendencies (Norberg et al., 2018). Individuals with hoarding disorder acquire and save possessions as a means of gaining control and coping with distress (Grisham et al., 2018; Kyrios et al., 2004; Phung et al., 2015; Steketee et al., 2003). Therefore, individuals with excessive saving tendencies may have engaged in panic buying to manage the stress associated with the COVID-19 pandemic. Moreover, engaging in panic buying may reinforce beliefs about the importance of possessions and strengthen hoarding tendencies in the long-term. Thus, the relationship between panic buying and hoarding may be cyclical such that greater hoarding

tendencies may lead to panic buying during calamitous events, and panic buying may lead to increased hoarding in the long-term.

Our primary aims were to determine which psychological factors were uniquely associated with panic buying and hoarding and whether panic buying early-on in the pandemic was associated with greater hoarding problems in the long-term. An exploratory aim of this study was to examine whether and how shopping habits changed during the pandemic—and, specifically, whether individuals thought supermarket-imposed buying limits reduced their own panic buying. We administered our study online to individuals from Australia and from the United States to test whether our hypothesised models could be replicated across samples. Based on theory and prior research, we hypothesised that perceived scarcity, intolerance of uncertainty, selfishness, and COVID-19-related health anxiety would predict higher levels of panic buying and hoarding. We also predicted that panic buying would be related to hoarding symptoms.

## 2. Methods

### 2.1. Participants and procedure

The study was open for participants to complete from July to September 2020. We chose to sample individuals from the US and Australia as they both are developed countries, had implemented similar strategies to minimise the spread of COVID-19 in the beginning of the pandemic, and had experienced mass consumer panic buying. In both countries panic buying peaked in March (Keane and Neal, 2020; Loxton et al., 2020; Prentice et al., 2020). Therefore, we collected retrospective data on participant panic buying during the initial months of the COVID-19 pandemic and data on hoarding tendencies during the time of data collection (4–6-month delay).

A total of 450 participants completed our study on Qualtrics, which was part of a larger battery of questionnaires examining the relationships between hoarding, compulsive buying, and underlying constructs such as object attachment and general motivations to acquire and save. The larger study was anticipated to take 70 minutes to complete. We recruited Australians using Macquarie University's undergraduate psychology pool ( $n = 191$ ) and through advertisements on social media and newsletters (i.e., Facebook, Twitter, IOCDF website and newsletter), and by contacting previous participants from our lab ( $n = 55$ ). Two community participants reported that they were currently living in the US and thus we included them as part of the US sample. We recruited US participants through Positly ( $n = 204$ ). Positly recruits MTurk users with high approval rates and blocks suspicious IP addresses and inattentive participants. Ethical approval for this study was provided by Macquarie University's Human Research Ethics Committee.

#### 2.1.1. Exclusions

Participants were excluded for the following reasons: they did not complete any measures relevant to the current study ( $n = 15$ ); they reported living in a country other than Australia or United States ( $n = 12$ ); they failed more than one attention check question (e.g., "Please select 'strongly disagree' for this item";  $n = 9$ ); or they completed the larger study in 30 minutes or less ( $n = 55$ ). After exclusions,  $N = 359$  participants' data were analysed. The majority (86.9%) of our Australian sample ( $n = 199$ ) lived in New South Wales whereas our US sample ( $n = 160$ ) represented 33 states, including 15% from California, 8.1% from New York, 7.5% from Florida, and 6.3% from Texas. See Table 1 for demographic information.

## 2.2. Materials

### 2.2.1. Demographics

Participants provided demographic information relating to their age, gender, ethnicity, marital status, highest level of education, employment, income, and country/state of residence.

**Table 1**  
Demographics.

	US (n = 160)		Australia (n = 199)		Comparison Statistics	Effect Size
	M	SD	M	SD		
Age	39.25	11.65	26.35	11.23	-10.64***	1.13
	n	%	n	%	$\chi^2$	$\phi$
Gender					65.54***	0.43
Female	59	36.9	156	78.4		
Male	99	61.9	40	20.1		
Other	2	1.2	3	1.5		
Ethnicity					64.11***	0.42
Caucasian	125	78.1	116	58.3		
Asian	11	6.8	41	20.6		
South Asian	-	-	17	8.5		
Black	15	9.4	2	1.0		
Hispanic	6	3.8	-	-		
Middle Eastern	-	-	14	7.0		
Other	3	1.9	9	4.5		
Marital Status					57.18***	0.40
Single	59	36.9	111	55.8		
Dating	12	7.5	41	20.6		
Long term/De-facto	6	3.7	14	7.0		
Married	68	42.5	26	13.1		
Divorced/Separated	15	9.4	5	2.5		
Widowed	-	-	2	1.0		
Education					83.77***	0.48
High school	42	26.3	123	61.8		
Vocational/Technical	14	8.8	32	16.1		
Bachelor's Degree	84	52.5	20	10.1		
Postgraduate	15	9.4	20	10.1		
Other	5	3.1	4	2.0		
Employment					123.98***	0.59
Full time	111	69.4	33	16.6		
Part time/Casual	24	15.0	98	49.2		
Student	4	2.5	50	25.1		
Unemployed	9	5.6	9	4.5		
Other	12	7.5	9	4.5		
Household Income					-	-
Under USD15k /AUD20k	4	1.1	36	10		
USD15-25k /AUD20-40k	12	3.3	12	3.3		
USD25-35k /AUD40-60k	16	4.5	23	6.4		
USD35-50k /AUD60-80k	39	10.9	14	3.9		
USD50-75k /AUD80-100k	46	12.8	12	3.3		
USD75-100k /AUD100-150k	24	6.7	21	5.8		
Over USD100k /AUD150k	16	4.5	34	9.5		
Prefer not to answer	1	0.3	47	13.1		

Note. n = 158 for US Household Income. Comparison statistics are not reported for income because our samples reported income in different currencies. \*\*\*p < .001.

**2.2.2. Panic buying**

Participants first read a definition of panic buying that described it as “A dramatic increase in purchasing of a particular type of product in the anticipation of shortage or price increases. A large amount is enough to last 3 months or more”. Then using one item, they rated “To what extent did you engage in panic buying in the first few months of the COVID-19 outbreak?” This item was rated on a 7-point scale ranging from 0 (not at all) to 6 (very much).

**2.2.3. Perceived scarcity**

Participants rated the following two items; (1) “During the first few months of the COVID-19 outbreak, to what extent were you worried that there would be shortage of food and necessary supplies?” and (2) “To what extent were others around you panic buying in the first few months of the COVID-19 outbreak?” These two items were rated on 7-point scales ranging from 0 (not at all) to 6 (very much). These variables (i. e., shortage worries and observed panic buying, respectively) were treated as two separate indicators of perceived scarcity.

**2.2.4. COVID-19 illness anxiety**

COVID-19 illness anxiety was measured with one item in which participants were asked “To what extent were you worried about becoming ill with COVID-19 in the first few months of the COVID-19 outbreak?” This

item was rated on a 7-point scale ranging from 0 (not at all) to 6 (very much).

**2.2.5. COVID-19 shopping patterns**

If participants engaged in panic buying to some extent (i.e., score of 1 or greater), they were asked “To what extent did buying restrictions stop you from panic buying?” Participants also rated the following item, “I shopped online more than I used to because of COVID-19.” These items were rated on a 7-point scale ranging from 0 (not at all) to 6 (very much). Participants also rated the extent to which COVID-19 changed their (1) shopping frequency and (2) amount of money they spent, during the first few months of the outbreak. These two items were rated on 7-point scales ranging from -3 (a lot less frequently/money) to +3 (a lot more frequently/money).

**2.2.6. Savings inventory – revised (SI-R; Frost et al., 2004)**

The SI-R is a 23-item questionnaire that measures hoarding symptoms on three dimensions; difficulty discarding (i.e., *How much control do you have over your urges to save possessions?*), excessive acquiring (i.e., *How strong is your urge to buy or acquire free things for which you have no immediate use?*), and clutter (i.e., *To what extent do you have so many things that your room(s) are cluttered?*). Participants indicated the degree to which they experienced each item over the past week on a 5-point

Likert scale from 0 (*none/not at all/never*) to 4 (*almost all/complete/extreme/very often*). This scale has previously demonstrated good test-retest reliability, convergent and divergent validity, and good internal consistency (Frost et al., 2004). The discarding, acquiring, and clutter subscales achieved  $\alpha = .90, .87,$  and  $.96$  (respectively) in the US sample and  $\alpha = .87, .76,$  and  $.91$  (respectively) in the Australian sample.

### 2.2.7. Selfishness questionnaire (SQ; Raine and Uh, 2019)

The SQ is a 24-item questionnaire that measures egocentric (i.e., I care for myself much more than I care for others), adaptive (i.e., I sometimes lie to others for my own good, and theirs too), and pathological selfishness (i.e., Now and again I've manipulated my friends to gain an advantage). Participants indicated the degree to which they agreed with each statement on a 3-point Likert scale from 0 (disagree) to 2 (agree). The SQ has demonstrated good validity, test-retest reliability and good internal consistency for the total scale (Raine and Uh, 2019). In this study, the egocentric, adaptive, and pathological subscales achieved  $\alpha = .80, .78,$  and  $.85$  (respectively) in the US sample and  $\alpha = .70, .69,$  and  $.74$  (respectively) in the Australian sample.

### 2.2.8. Intolerance of uncertainty scale (IUS; Buhr and Dugas, 2002)

The IUS is a 27-item questionnaire that measures intolerance of uncertainty (i.e., *Uncertainty makes me uneasy, anxious, or stressed*). Participants indicated the degree to which they agreed with each statement on a 5-point Likert scale from 1 (*not at all true of me*) to 5 (*very much true of me*). The IUS has previously demonstrated good test-retest reliability, convergent and divergent validity, and excellent internal consistency in non-clinical samples (Buhr and Dugas, 2002; Sexton and Dugas, 2009). In this study, the total score achieved  $\alpha = .97$  in the US sample and  $\alpha = .95$  in the Australian sample.

## 2.3. Statistical analyses

All analyses were conducted on SPSS v25 (IBM, 2017). We first examined histograms, q-q plots, boxplots, skewness, and kurtosis statistics, and found that all variables were approximately normally distributed and had no significant outliers. Because of this, we decided to treat all one-item variables as continuous, and thus used parametric statistics. We found that assumptions were met for all subsequent analyses. To see how our two samples differed and address our exploratory aims, we compared them on all study variables with independent *t*-tests. These *t*-tests When Levene's test was significant ( $p < .05$ ), the Welch-Satterthwaite adjustment was used. To look at the relationships between study variables with panic buying and hoarding, we computed Pearson correlations between all study variables, split by sample.

To address our primary aim, we conducted multiple linear regression models for each sample which examined panic buying predicted by shortage worries, observed panic buying, COVID-19 anxiety, intolerance of uncertainty, egocentric selfishness, adaptive selfishness, and pathological selfishness. To examine whether panic buying and relevant COVID-19 variables were associated with hoarding problems (difficulty discarding, excessive acquisition, and clutter) later on, we conducted a series of multiple regressions. For each regression model, the predictors were panic buying, shortage worries, observed panic buying, COVID-19 anxiety, intolerance of uncertainty, egocentric selfishness, adaptive selfishness, and pathological selfishness.

## 3. Results

### 3.1. Sample comparisons on demographics and study variables

We first examined the demographic characteristics of each sample. An independent samples *t*-test on age revealed that US participants were significantly older. Chi-square tests showed significant associations between country and gender, ethnicity, marital status, education, and employment. The majority of participants in the US sample were male,

married, had a bachelor's degree, and full-time employment, whereas most participants in the Australian sample were female, single, had only completed high school, and reported part time or casual employment. These characteristics are consistent with our recruitment methods. The ethnic make-up of both samples was consistent with previous US MTurk and Australian undergraduate samples (e.g., Norberg et al., 2017; Yap and Grisham, 2019). See Table 1 for comparison statistics and effect sizes.

Table 2 depicts the sample comparisons for the study variables. The US sample engaged in significantly more panic buying ( $M = 2.61$  on a scale from 0 to 6) than our Australian sample ( $M = 1.53$ ; medium effect); though both samples indicated low engagement in panic buying on average. Similarly, both Australians and Americans reported seeing other people panic buying and being worried about shortages in food and essential supplies; the US sample reported these to a greater extent (small and large effects, respectively). For Australians and Americans who reported panic buying to some extent, they also reported that buying restrictions moderately helped them reduce their panic buying, and the difference between the samples on this measure was non-significant and of trivial magnitude. Both Americans and Australians also reported a moderate increase in online shopping due to COVID-19—Americans more so (medium effect size). By contrast, neither sample reported substantial change for shopping frequency and the difference between samples was not statistically significant. Although the US sample reported increasing their spending more so than Australians (medium effect), their overall increase in spending was low ( $M = 0.89$  on a scale from -3 to +3).

Regarding hoarding symptoms, there was no significant difference between our US and Australian samples on difficulty discarding, excessive acquisition, or clutter. However, the US sample reported significantly greater COVID-19 health anxiety than the Australian sample (small effect). The US sample also reported significantly greater egocentric selfishness (moderate effect) and pathological selfishness (small effect) compared to the Australian sample. There was no statistically significant difference in level of intolerance of uncertainty between samples.

### 3.2. Correlations between panic buying, hoarding, and other psychological factors

See Table 3 for observed Pearson correlations between all variables, split by country. As hypothesised, panic buying was moderately and positively related to difficulty discarding, excessive acquisition, and clutter. Also, greater panic buying was significantly related to greater online shopping, shopping more frequently (only for the US sample), and spending more money, and these were medium sized effects. As hypothesised, panic buying was positively related to COVID-19 health anxiety, seeing others panic buy, and worries about shortages of food or essential supplies (medium to large effect sizes). However, contrary to hypotheses, panic buying was not significantly related to intolerance of uncertainty or selfishness in either sample.

As hypothesised, hoarding symptoms (difficulty discarding, excessive acquisition, and clutter) were significantly related to seeing others panic buy, but only for the Australian sample. Greater difficulty discarding and excessive acquisition were moderately related to greater worries about shortages of food or essential supplies and COVID-19 health anxiety. As expected, intolerance of uncertainty was moderately and positively related to hoarding symptoms. Greater egocentric and pathological selfishness were related to greater hoarding symptoms, but only for the US sample (medium effect sizes). Also, excessive acquisition was related to increases in online shopping and shopping frequency (small effects).

### 3.3. Predicting panic buying and hoarding

See Table 4 for summaries of linear models predicting panic buying.



**Table 2**  
Sample comparisons for study variables.

	US (n = 160)		Australia (n = 199)		t	p	d
	M	SD	M	SD			
SI-R – Difficulty Discarding	8.33	5.79	9.15	5.45	1.38	.17	0.15
SI-R – Excessive Acquiring	7.60	5.43	8.24	4.33	1.21	.23	0.13
SI-R – Clutter	7.25	7.65	7.18	6.22	-0.10	.92	0.01
Panic Buying	2.61	1.80	1.53	1.62	-5.97	<.001	0.63
Observed Panic Buying	4.19	1.55	3.79	1.80	-2.26	.02	0.24
COVID-19 Anxiety	3.43	1.88	2.76	1.94	-3.29	.001	0.35
Shortage Worries	3.88	1.67	2.60	1.72	-7.06	<.001	0.76
IUS	69.30	26.37	67.98	20.51	-0.52	.61	0.06
SQ – Egocentric	6.17	4.07	4.29	3.10	-4.81	<.001	0.52
SQ – Adaptive	8.50	4.17	7.70	3.60	-1.91	.06	0.21
SQ – Pathological	5.96	4.51	4.90	3.58	-2.41	.02	0.26
Buying Restrictions	3.03	1.74	3.26	1.76	-1.02	.31	0.13
Online Shopping	3.87	1.95	2.70	2.17	-5.35	<.001	0.57
Shopping Frequency	0.16	1.88	0.18	1.76	0.10	.92	0.01
Spending Amount	0.89	1.39	0.10	1.83	-4.67	<.001	0.49

Note. IUS = Intolerance of Uncertainty Scale. SI-R = Savings Inventory – Revised. SQ = Selfishness Questionnaire. In the Australian sample, for the IUS and SQ, n = 196 and n = 195, respectively, because some participants did not complete the study. For the Buying Restrictions measure, n = 121 for the US sample, and n = 117 for the Australian sample because participants who reported not panic buying at all were not asked whether buying restrictions affected their panic buying, and other participants reported no buying restrictions in the shops they frequented.

In the Australian sample, shortage worries, observed panic buying, and COVID-19 anxiety were found to uniquely contribute to panic buying. Shortage worries had a larger effect size than COVID-19 anxiety and observed panic buying. In the US sample, we observed a similar pattern of results, though observed panic buying was not a statistically significant predictor. In both samples, the intolerance of uncertainty and selfishness variables had trivial nonsignificant effects.

See Table 5 for summaries of linear models predicting difficulty discarding 4-6 months into the COVID-19 pandemic. For both samples, intolerance of uncertainty was found to contribute the largest amount of unique variance to difficulty discarding. Panic buying at the start of the pandemic also contributed unique variance, although it had a smaller effect. For the US sample, adaptive selfishness contributed unique variance to difficulty discarding such that *less* adaptive selfishness was related to *greater* difficulty discarding. This effect was not replicated in the Australian sample.

See Table 6 for summaries of linear models predicting excessive acquisition 4-6 months into the COVID-19 pandemic. For both samples, intolerance of uncertainty and panic buying at the start of the pandemic contributed the largest amount of unique variance, although effects were smaller in the Australian sample. In the Australian sample, observed panic buying at the start of the pandemic contributed unique variance to excessive acquiring (not replicated in the US sample). In the US sample, adaptive and pathological selfishness had opposite effects on excessive acquisition such that *less* adaptive selfishness and *greater* pathological selfishness were related to *greater* excessive acquiring (not replicated in the Australian sample). All other effects were trivial and nonsignificant.

See Table 7 for summaries of linear models predicting clutter 4-6 months into the COVID-19 pandemic. For both samples, intolerance of uncertainty and panic buying at the start of the pandemic contributed unique variance to clutter. In the US sample, all types of selfishness contributed a larger amount of variance to clutter, such that *less* adaptive, *greater* egocentric, and *greater* pathological selfishness were related to *greater* clutter (not replicated in the Australian sample). All other effects were trivial and nonsignificant.

#### 4. Discussion

The main aims of this study were to examine how COVID-19 changed shopping habits and investigate the psychological factors that led to panic buying, while also testing whether panic buying that occurred at the start of the pandemic was associated with hoarding severity four to six months later. We also wanted to know whether findings would

replicate across samples in the United States and Australia. We found that, on average, both our US and Australian samples reported increases in online shopping due to COVID-19 but not much change in shopping frequency or spending amount, which suggests that most individuals changed how they purchased consumer goods rather than how much they consumed. However, both samples engaged in panic buying, with the US sample engaging in panic buying to a greater extent. This may have occurred because the Australian sample largely consisted of younger undergraduate students who likely lived at home with their parents (AIFS, 2020) and may not have been responsible for household shopping. Both samples reported that supermarket-imposed buying restrictions were moderately effective in reducing their panic buying. We found that panic buying was correlated with hoarding, and yet, our analyses suggested that these problems had differing psychological correlates. Panic buying was most strongly predicted by greater worries about shortages of food and necessary supplies. COVID-19 health-related anxiety and seeing other people panic buy also predicted panic buying behaviour. On the other hand, hoarding symptoms 4-6 months into the pandemic were most strongly associated with panic buying at the start of the pandemic and a general tendency to be intolerant of uncertainty. Greater egocentric and pathological selfishness were also related to greater hoarding problems, while greater adaptive selfishness was related to less hoarding problems, though these effects were only observed in the US sample.

Building off previous research on panic buying (Yuen et al., 2020), our results suggest that perceived scarcity seems to be most uniquely associated with panic buying, especially when compared to other constructs such as selfishness or intolerance of uncertainty. Thus, acute psychological factors, rather than dispositional, seem to trigger panic buying. Unlike one prior study (Bentall et al., 2021), we found that intolerance of uncertainty was not related to panic buying or to changes in shopping frequency or changes in spending. This may be because Bentall et al. (2021) utilised the 12-item Intolerance of Uncertainty Scale (Carleton et al., 2007), which may have slightly different psychometric properties. We also did not replicate previous research which found that selfishness was related to panic buying (Oosterhoff and Palmer, 2020). Using a non-validated measure of selfishness, Oosterhoff and Palmer (2020) observed a trivial effect size between selfishness and panic buying ( $r = .09$ ), which our study was not powered to detect. Future studies may want to examine if different measures of intolerance of uncertainty and selfishness lead to differential findings. Future studies should also ask about the purchasing of different types of products. For example, Zhang and Zhou (2021) found that perceived risk of COVID-19 was related to panic buying masks and food, though only panic buying of

**Table 3**  
Correlations among variables.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
AU	1. SI-R Discarding	-																
	2. SI-R Acquiring	.62**	-															
	3. SI-R Clutter	.53**	.38**	-														
	4. Panic Buying	.25**	.29**	.23**	-													
	5. Observed Panic Buying	.23**	.27**	.22**	.38**	-												
	6. COVID-19 Anxiety	.18*	.18*	.07	.44**	.28**	-											
	7. Shortage Worries	.20**	.24**	.11	.51**	.35**	.52**	-										
	8. IUS	.35**	.24**	.24**	.06	.19**	.20**	.18*	-									
	9. SQ - Egocentric	.05	.12	.04	-.03	-.09	-.07	-.03	.06	-								
	10. SQ – Adaptive	.10	.16*	.05	-.03	-.03	-.06	.07	.10	.48**	-							
	11. SQ – Pathological	.03	.15*	.01	-.03	-.04	-.05	.04	.16*	.60**	.69**	-						
	12. Buying Restrictions	.17	.18*	.17	.30**	.30**	.21*	.25**	-.04	.04	.09	.07	-					
	13. Online Shopping	.03	.23**	.01	.25**	.15*	.27**	.22**	.05	-.04	.03	.12	.09	-				
	14. Shopping Frequency	.03	.18**	-.01	.13	.10	.12	.04	.09	-.03	.06	<.01	.11	.35**	-			
	15. Spending Amount	.09	.27**	.01	.28**	.14	.17*	.12	.13	<.01	.08	-.01	.22*	.30**	.72**	-		
	16. Age	-.03	-.10	<.01	.04	-.12	-.17*	-.03	-.11	-.06	-.07	-.07	-.01	-.23**	.01	.04	-	
	17. Gender	.07	.07	-.02	.16*	.19**	.13	.12	-.01	-.30**	-.26**	-.33**	-.01	.11	<.01	.01	-.06	-
	18. Income (AUD)	-.05	-.13	-.10	.09	.08	.09	.13	-.13	-.09	.12	.04	-.13	.04	-.07	-.03	-.02	.02
US	1. SI-R Discarding	-																
	2. SI-R Acquiring	.70**	-															
	3. SI-R Clutter	.71**	.70**	-														
	4. Panic Buying	.28**	.36**	.36**	-													
	5. Observed Panic Buying	.05	.03	-.04	.38**	-												
	6. COVID-19 Anxiety	.23**	.18*	.22**	.45**	.31**	-											
	7. Shortage Worries	.22**	.23**	.19*	.60**	.48**	.55**	-										
	8. IUS	.48**	.57**	.39**	.15	.02	.19*	.14	-									
	9. SQ - Egocentric	.24**	.28**	.31**	.03	<.01	-.17*	-.05	.33**	-								
	10. SQ – Adaptive	.08	.15	.07	.09	.12	-.08	.02	.20*	.68**	-							
	11. SQ – Pathological	.23**	.37**	.33**	.08	-.04	-.01	.02	.28**	.66**	.76**	-						
	12. Buying Restrictions	.03	.08	.07	.19*	.01	.17	.29**	.08	.15	.03	.07	-					
	13. Online Shopping	.08	.19*	.09	.33**	.14	.27**	.28**	.12	-.06	.05	.12	.16	-				
	14. Shopping Frequency	.06	.18*	.10	.33**	.10	-.01	.23**	<.01	.19*	.27**	.13	.13	.12	-			
	15. Spending Amount	.04	.07	.03	.46**	.31**	.17*	.39**	-.04	.01	.07	-.06	.06	.21**	.64**	-		
	16. Age	-.16*	-.25**	-.18*	-.15	-.08	-.13	-.09	-.26**	-.22**	-.15	-.19*	-.06	-.15	-.08	-.04	-	
	17. Gender	.01	.06	-.03	.07	.10	.07	.04	.05	-.32**	-.16*	-.10	-.13	.02	-.03	-.04	.15	-
	18. Income (USD)	<.01	-.01	.06	.01	-.10	-.20*	-.14	-.01	-.12	-.14	-.04	-.03	.07	-.06	-.10	-.10	.02

Note. IUS = Intolerance of Uncertainty Scale. SI-R = Savings Inventory - Revised. SQ = Selfishness Questionnaire. Bolded correlations indicate differences in significance between samples. \*p < .05. \*\*p < .01.

**Table 4**  
Summary of models predicting panic buying.

	US (n = 160)					Australia (n = 195)				
	B	SE	b	t	p	B	SE	b	t	p
Constant	-0.78	0.47		-1.65	.10	-0.04	0.41		-1.10	.92
Shortage Worries	0.49	0.09	.45	5.59	<.001	0.33	0.07	.35	4.85	<.001
Observed Panic Buying	0.12	0.09	.11	1.42	.16	0.20	0.06	.221	3.43	.001
COVID-19 Anxiety	0.17	0.08	.18	2.28	.02	0.17	0.06	.21	2.91	.004
IUS	0.002	0.01	.02	0.33	.74	-0.01	0.01	-.08	-1.25	.21
SQ - Egocentric	0.02	0.04	.04	0.43	.67	0.02	0.04	.03	0.44	.66
SQ - Adaptive	0.01	0.05	.03	0.24	.81	-0.02	0.04	-.04	-0.54	.59
SQ - Pathological	0.01	0.04	.03	0.28	.78	0.001	0.04	.001	0.01	.99
	<b>R<sup>2</sup> = .405, F(7, 152) = 29.88, p &lt; .001</b>					<b>R<sup>2</sup> = .341, F(7, 187) = 13.81, p &lt; .001</b>				

Note. IUS = Intolerance of Uncertainty Scale. SQ = Selfishness Questionnaire.

**Table 5**  
Summary of models predicting SI-R difficulty discarding.

	US (n = 160)					Australia (n = 195)				
	B	SE	b	t	p	B	SE	b	t	p
Constant	0.32	1.65		0.19	.85	0.11	1.53		0.08	.94
Panic Buying	0.57	0.28	.18	2.05	.04	0.62	0.27	.19	2.29	.02
Shortage Worries	0.13	0.33	.04	0.39	.70	0.05	0.27	.02	0.18	.86
Observed Panic Buying	-0.10	0.30	-.03	-0.32	.75	0.38	0.22	.13	1.72	.09
COVID-19 Anxiety	0.24	0.26	.08	0.90	.37	0.01	0.22	.003	0.04	.97
IUS	0.08	0.02	.38	5.10	<.001	0.08	0.02	.30	4.24	<.001
SQ - Egocentric	0.26	0.14	.18	1.79	.08	0.14	0.14	.08	0.99	.33
SQ - Adaptive	-0.37	0.16	-.27	-2.33	.02	0.22	0.14	.15	1.62	.11
SQ - Pathological	0.24	0.15	.19	1.68	.09	-0.25	0.15	-.16	-1.62	.11
	<b>R<sup>2</sup> = .321, F(8, 151) = 8.93, p &lt; .001</b>					<b>R<sup>2</sup> = .199, F(8, 186) = 5.76, p &lt; .001</b>				

Note. IUS = Intolerance of Uncertainty Scale. SQ = Selfishness Questionnaire. SI-R = Savings Inventory - Revised.

**Table 6**  
Summary of models predicting SI-R excessive acquiring.

	US (n = 160)					Australia (n = 195)				
	B	SE	b	t	p	B	SE	b	t	p
Constant	-0.48	1.33		-0.36	.72	1.84	1.25		1.47	.14
Panic Buying	0.92	0.23	.30	4.06	<.001	0.52	0.22	.19	2.35	.02
Shortage Worries	0.11	0.27	.03	0.40	.69	0.12	0.22	.05	0.57	.57
Observed Panic Buying	-0.10	0.24	-.03	-0.39	.70	0.39	0.18	.16	2.17	.03
COVID-19 Anxiety	-0.18	0.21	-.06	-0.87	.39	-0.01	0.18	-.01	-0.08	.94
IUS	0.09	0.01	.46	7.18	<.001	0.03	0.02	.16	2.20	.03
SQ - Egocentric	0.07	0.12	.05	0.59	.56	0.10	0.12	.08	0.89	.38
SQ - Adaptive	-0.46	0.13	-.35	-3.52	.001	0.13	0.11	.11	1.13	.26
SQ - Pathological	0.54	0.12	.45	4.62	<.001	0.02	0.12	.02	0.19	.85
	<b>R<sup>2</sup> = .496, F(8, 151) = 18.60, p &lt; .001</b>					<b>R<sup>2</sup> = .173, F(8, 186) = 4.88, p &lt; .001</b>				

Note. IUS = Intolerance of Uncertainty Scale. SQ = Selfishness Questionnaire. SI-R = Savings Inventory - Revised.

**Table 7**  
Summary of models predicting SI-R clutter.

	US (n = 160)					Australia (n = 195)				
	B	SE	b	t	p	B	SE	b	t	p
Constant	0.83	2.02		0.41	.68	-0.19	1.86		-0.10	.92
Panic Buying	1.45	0.34	.34	4.22	<.001	0.86	0.33	.22	2.57	.01
Shortage Worries	-0.11	0.41	-.02	-0.27	.79	-0.23	0.32	-.06	-0.70	.48
Observed Panic Buying	-0.56	0.37	-.11	-1.52	.13	0.44	0.27	.12	1.62	.11
COVID-19 Anxiety	0.37	0.32	.09	1.15	.25	-0.23	0.27	-.07	-0.84	.40
IUS	0.06	0.02	.21	3.03	.003	0.07	0.02	.23	3.22	.002
SQ - Egocentric	0.57	0.18	.30	3.21	.002	0.13	0.18	.07	0.75	.46
SQ - Adaptive	-0.91	0.20	-.50	-4.64	<.001	0.16	0.17	.09	0.93	.35
SQ - Pathological	0.71	0.18	.42	4.00	<.001	-0.21	0.19	-.12	-1.12	.27
	<b>R<sup>2</sup> = .414, F(8, 151) = 13.34, p &lt; .001</b>					<b>R<sup>2</sup> = .126, F(8, 186) = 3.36, p = .001</b>				

Note. IUS = Intolerance of Uncertainty Scale. SQ = Selfishness Questionnaire. SI-R = Savings Inventory - Revised.



food was related to refusing home visitors and cancelling outings (i.e., indicators of social distancing).

To our knowledge, our study was one of the first to examine the links between the COVID-19 pandemic and hoarding problems, distinguishing it from panic buying. Although hoarding was related to COVID-19 health-related anxiety and perceived scarcity (i.e., worries about shortages of food or necessary supplies and observed panic buying) at the univariate level, these relationships were not found at the multivariate level. Both panic buying at the start of the pandemic and intolerance of uncertainty were uniquely associated with hoarding problems 4-6 months into the pandemic. The relationships between panic buying and hoarding symptoms at the univariate and multivariate level could also mean that individuals with pre-existing hoarding symptoms were more likely to panic buy at the start of the pandemic. This would be consistent with previous research that has shown strong and reliable relationships between excessive acquiring and other hoarding problems (e.g., Frost et al., 2004). Interestingly, adaptive selfishness had the opposite effect on hoarding when compared to egocentric and pathological selfishness. These findings indicate that hoarding is associated with *greater* selfishness focused on the self (i.e., egocentric), *greater* selfishness focused on harming others (i.e., pathological), and *less* selfishness in the interest of the self and close others (i.e., adaptive). These findings are consistent with previous research which has found that individuals who hoard seem to do so often at the expense of the well-being of family members (Drury et al., 2014; Tolin et al., 2008). Hoarding is thought to have an evolutionary basis in that it should prevent individuals from being caught unprepared (Frost and Gross, 1993). If true, a threat to product availability should motivate hoarding behaviour (i.e., difficulty discarding possessions). Although the COVID-19 pandemic is unprecedented and should incite considerable uncertainty, our COVID-19 variables only evidenced small relationships with the Intolerance of Uncertainty Scale. Thus, it seems that health-related anxiety and perceived scarcity can be experienced by individuals who do not hold pervasive, maladaptive beliefs that uncertainty is negative and impairs a person's ability to function. It also means individuals who hoard possessions may do so regardless of whether an actual threat to product availability exists. The initial shock of the pandemic may have simply provided another motive for saving possessions. Since this has resolved, individuals who hoard will likely continue to do so for other reasons that incite uncertainty. Therefore, our findings are consistent with previous research which suggests that panic buying is an acute response which subsides after a disaster (Yuen et al., 2020), while hoarding tends to be a chronic problem (Tolin et al., 2010).

Our findings should be interpreted while considering the limitations of our study. First, we collected retrospective data on panic buying and COVID-19 related constructs with a lag of approximately 4-6 months. This may have affected the reliability of our measurements; for example, we measured panic buying behaviours several months after they occurred. Second, we did not collect data on hoarding problems at the beginning of the pandemic, which prevents us from determining why panic buying and hoarding symptoms are related. Third, social desirability bias may have affected our results because some participants may have been more selfish and may have panic bought more than they indicated in our measures. Fourth, we cannot draw causal inferences on the determinants of panic buying and hoarding as our data are cross-sectional. Future research could address these limitations by priming participants with imagined disasters and then using behavioural measures in the lab. Fifth, some of our measures (e.g., panic buying) were not validated and only consisted of one item, which may have affected the reliability of our findings. Last, our samples were not representative of their respective populations. Future research should aim to recruit samples that reflect the demographic characteristics of the larger population.

#### 4.1. Practical implications

Our research has important implications for the way pandemics and public health issues are handled in the future. As panic buying was associated with worries about shortages of food and/or necessary supplies, we recommend that policies be put in place to limit perceived scarcity cues in the community. For example, public health bodies and retailers may have an important role to play in anticipating and preventing mass panic buying. Because the announcement of public health measures such as social distancing and lockdowns seem to coincide with surges of panic buying (Keane and Neal, 2020; Prentice et al., 2020), public health bodies could work more closely with retailers and their relevant supply chains to increase product stocks during disasters. Thus, widespread panic buying could be anticipated and mitigated by increasing product availability. However, because it may be difficult to anticipate when governments will implement public health measures, reliance on buying restrictions may be important. Even though buying restrictions may increase perceived scarcity, our findings show that they reduce panic buying. Lastly, because social media and mainstream media outlets seem to have a large influence on the spread of consumer panic (Arafat et al., 2020; Islam et al., 2020; Kim et al., 2020; Laato et al., 2020; Naeem, 2021), increasing reassurance messages from retailers (e.g., that they have more than enough supplies for all consumers) and prosocial responses to disasters (e.g., individuals providing essential items to others in their local communities) through these mediums could reduce panic buying in the public (Arafat et al., 2020; Mortimer and Bowden, 2020). However, if *actual* shortages exist (rather than perceived), it would be important for this information to be communicated honestly to the public, with a plan to draw towards collective good and minimise panic (i.e., Risk and Crisis Communication; Covelto, 2003). One possible preventative measure to reduce hoarding problems could be to increase public awareness and implement education programmes on television and social media, and by educating school students. Given that we found intolerance of uncertainty was associated with hoarding, such educational programs should help people to learn to tolerate uncertainty and distress as this may help reduce excessive acquiring and saving.

#### 4.2. Conclusion

In summary, our study highlights the association between perceived scarcity and panic buying behaviour, distinguishing this maladaptive response from hoarding problems. Our study was also the first to examine the impact of COVID-19 on hoarding. Our data suggested that hoarding 4-6 months into the pandemic was uniquely associated with a general intolerance of uncertainty and panic buying at the start of the pandemic. Taking together findings from the current study and previous literature, selfishness does not seem to have a large impact on panic buying behaviour. Future research should continue to develop our understanding of why people engage in excessive acquiring and saving behaviours as this may lead to better strategies to prevent and reduce the negative consequences of these problems.

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#### CRediT authorship contribution statement

**Jonathan David:** Conceptualization, Methodology, Project administration, Formal analysis, Data curation, Writing – original draft. **Shanara Visvalingam:** Writing – original draft, Writing – review & editing. **Melissa M. Norberg:** Supervision, Conceptualization, Methodology, Writing – review & editing.

## Declarations of Competing Interest

None.

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