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Published in:
Journal of Affective Disorders

DOI:
[10.1016/j.jad.2023.06.042](https://doi.org/10.1016/j.jad.2023.06.042)

Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

[Link to publication in Tilburg University Research Portal](#)

Citation for published version (APA):

Van der velden, P. G., Contino, C., De vroege, L., Das, M., Bosmans, M., & Zijlmans, J. (2023). The prevalence of anxiety and depression symptoms (ADS), persistent and chronic ADS among the adult general population and specific subgroups before and during the COVID-19 pandemic until December 2021. *Journal of Affective Disorders*, 338, 393-401. <https://doi.org/10.1016/j.jad.2023.06.042>

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Research paper

The prevalence of anxiety and depression symptoms (ADS), persistent and chronic ADS among the adult general population and specific subgroups before and during the COVID-19 pandemic until December 2021

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ARTICLE INFO

Keywords:
 COVID-19
 Anxiety
 Depression
 Chronic
 Population
 Prospective

ABSTRACT

Background: It is unclear to what extent the prevalence of moderate and severe anxiety and depression symptoms (ADS) is higher during the first 20 months after the COVID-19 outbreak than before the outbreak. The same holds for persistent and chronic ADS among the adult general population and subgroups (such as employed, minorities, young adults, work disabled).

Methods: Data were extracted from six surveys conducted with the Dutch longitudinal LISS panel, based on a traditional probability sample ($N = 3493$). Biographic characteristics and ADS (MHI-5 scores) were assessed in March–April 2019, November–December 2019, March–April 2020, November–December 2020, March–April 2021, and November–December 2021. Generalized estimating equations were conducted to examine differences in the prevalence of post-outbreak ADS, persistent and chronic ADS compared to the pre-outbreak prevalence in similar periods. The Benjamini-Hochberg correction for multiple testing was applied.

Results: Among the general population *chronic moderate* ADS increased significantly but slightly in the period March–April 2020 to March–April 2021 compared to a similar period before the pandemic (11.9 % versus 10.9 %, Odds Ratio = 1.11). In the same period a somewhat larger significant increase in *chronic moderate* ADS was observed among 19–24 years old respondents (21.4 % versus 16.7 %, Odds Ratio = 1.35). After the Benjamini-Hochberg correction several other differences were no longer significant.

Limitations: No other mental health problems were assessed.

Conclusions: The Dutch general population and most of the assessed subgroups were relatively resilient given the limited increase or absence of increases in (persistent and chronic) ADS. However, young adults suffered from an increase of chronic ADS.

1. Introduction

On March 11, 2020, the WHO declared the novel coronavirus (COVID-19) outbreak a global pandemic after dramatic increases of infection rates in several countries such as China and Italy (Cucinotta

and Vanelli, 2020). The effects of this pandemic were and are dramatic: until June 2022, approximately 6.3 million people died due to the virus (WHO, 2022a), the pandemic triggered the largest global economic crisis in more than a century (World Bank, 2022), the overload of COVID-19 patients forced hospitals to postpone planned care and

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<https://doi.org/10.1016/j.jad.2023.06.042>

Received 11 August 2022; Received in revised form 28 May 2023; Accepted 20 June 2023

Available online 25 June 2023

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treatment (Moynihan et al., 2021), and preventive measures to contain the virus such as lockdowns and social distancing rules further disrupted societies. Fortunately, in 2021 effective COVID-19 vaccines became available leading to a sharp decline in infection and mortality risks. From the end of 2021 to the spring of 2022, across the globe, preventive measures were phased out to a greater or lesser extent (for details, see interactive COVID-19 Government Response Tracker; Oxford University, 2022), although in for instance China large lockdowns still occur as a result of the zero covid policy (Dyer, 2022).

The outbreak immediately raised the important question to what extent this pandemic and related health risks, disruptions, and other stressful consequences negatively affected the mental health of the general population and specific vulnerable subgroups. It was the starting point of a very large number of studies devoted to this question. For instance, a search on PUBMED at the end of June 2022 with the key words “COVID-19”, “mental health”, “anxiety” and “depression” identified almost 27,000 peer-reviewed articles (about 6300 in 2020, 13,200 in 2021, and 7100 in 2022 until June) including about 400 meta-analyses. Of these studies, especially empirical studies using prospective study designs with pre-outbreak data or comparable reference data on mental health based on traditional probability and non-convenience samples are relevant. They enable reliable estimates of changes in the prevalence mental health problems, persistent or chronic mental health problems due to this pandemic (cf. Bradley et al., 2021; Kessler et al., 2022; Riepenhausen et al., 2022). Pre-existing mental health problems are important confounding variables, and it must be ruled out that the observed disparities in post-outbreak mental health problems were already present before the outbreak or do not differ from pre-outbreak prevalence among comparable populations (cf. Chen et al., 2022; DiGangi et al., 2013; Ernst et al., 2022; Hafstad et al., 2021; Knox et al., 2022).

To date, a relatively small minority of COVID-19 studies on mental health have used such prospective probability-based designs. The large majority of these studies was aimed at the adult general population or subgroups within the general population such as males and females and different age categories, and focused on anxiety and depression symptomatology. A meta-analysis of 65 cohort studies published before January 11, 2021, among the general population by Robinson et al. (2022) found a higher prevalence of mental health problems during the first months after the outbreak during the first lockdown returning to normal pre-outbreak levels after the summer in 2020 (cf. Leung et al., 2022). In a follow-up study, Daly and Robinson (2022) found a subsequent increase during the second lockdown in the UK (around January 2021) among its general population (cf. COVID-19 Mental Disorders Collaborators, 2021; Daly and Robinson, 2022; Patel et al., 2022), suggesting that the increases were/are time-limited and transient (cf. Pedersen et al., 2022; Riepenhausen et al., 2022). A similar pattern was observed across prospective studies among adolescents with pre-outbreak data on mental health: prospective studies conducted during the first months after the outbreak showed an increase of mental health problems, in contrast to studies conducted around the end of 2020 (van der Velden et al., 2022a). However, with respect to mental disorders among the general population in Norway, Knudsen et al. (2021) found, besides a decrease in the prevalence of mental disorders (CMD) in the first pandemic period compared to before the outbreak, stable levels of mental disorders, suicidal ideation, and suicide death.

Other studies focused on specific subgroups such as employed and employed with children, young adults, people with disabilities and chronic conditions. With respect to employed people, the large majority focused on (frontline) health care and mental health care workers (HCWs). Meta-analysis and an umbrella review of 44 meta-analyses of studies among HCWs (cf. Aymerich et al., 2022; Dragioti et al., 2022; Li et al., 2021; Olaya et al., 2021) suggested a strong increase in mental health problems due to this pandemic given the relatively high prevalence rates of post-outbreak mental health problems among HCWs. However, since most— if not all— studies were initiated after the

COVID-19 outbreak no conclusions about the effects of this pandemic on the mental health of HCWs can be drawn, except for of course COVID-19 related fears (Alimoradi et al., 2022; Metin et al., 2022). The extent to which these findings can be generalized to employed individuals in general population is unknown.

Similar findings, strengths, and limitations were observed in studies that focused on other groups including, but not restricted to, teachers, migrant workers, and mothers of young children (see meta-analyses of Ma et al., 2022a; Oliva-Arocas et al. (2022), and Racine et al. (2021), respectively). Due to all lockdowns, part of the working population was forced to work from home, but studies on the effects of this change in work/home balance showed mixed findings (Abiddin et al., 2022; Oakman et al., 2020; Shimura et al., 2021). For instance, in one of the few prospective studies by Shimura et al. (2021), remote work was associated with a reduction of psychological and physical stress responses at follow-up (August 2020 to November 2020) compared to pre-outbreak levels. Similarly, in the study by Griffiths et al. (2022), a decrease of psychological distress and improvement of mental health up to December 2020 was observed among those who worked at baseline (March 2020).

Relatively few prospective studies focused on people with existing disabilities and chronic conditions. Steptoe and Di Gessa (2021) found that people with impairments, e.g., basic and instrumental activities of daily living (ADL), more often had clinically significant symptoms of depression and impaired sleep quality than people without ADL, while controlling for the same pre-outbreak variables. However, among adults with chronic disease, Davis et al. (2021) found no indications of worsening mental health during the first months compared to the month before the outbreak. A meta-analysis of studies among people with multiple sclerosis showed no significant increase in levels of anxiety, depression, and mental quality of life, in contrast to sleep quality (Altieri et al., 2022).

1.1. Aims present study

In sum, there is a lack of prospective probability-based studies on the effects of this pandemic on the mental health of the adult general population in the longer term, e.g., until the end of 2021, and relevant subgroups such as employed adults, employed adults with children at home, young adults, (partial) work disabled and adults with a non-western background (living in Western countries). Moreover, the duration of the pandemic and ongoing stressors raise the question to what extent this pandemic hindered the normal recovery of mental health problems: was the prevalence of persistent and chronic mental health problems during this pandemic higher than in similar periods before this pandemic? Van der Velden et al. (2021, 2022b) found no indications that during the 9 months after the outbreak, the prevalence and incidence of mental health problems differed from a similar period before the outbreak among the Dutch general population. Several studies found no indications that mental health problems strongly increased among those with existing pre-COVID-19 mental health problems up to February 2021 (Kok et al., 2022; Pan et al., 2021; Pedruzo et al., 2022). However, the pattern on the longer term among the general population as well as specific subgroups is largely unknown. In addition, even if the prevalence of post-outbreak mental health problems in the longer term is found to be relatively stable, a higher prevalence of persistent and chronic mental health problems may still be present.

The aim of the present multi-wave prospective probability-based study was to fill these gaps of scientific knowledge. Our research question was: Does the prevalence of a.) moderate and severe anxiety and depression symptoms (ADS) and b.) persistent and chronic moderate and severe ADS differ significantly between the COVID-19 period up to November–December 2021 and similar periods before the outbreak in the general population and specific subgroups within the general population. Subgroups such as employed, employed with children at home, young adults, non-western, ethnic minorities and (partial) work disabled?

2. Methods

2.1. Procedures and participants

For the present study, data were extracted from six anonymized surveys conducted with the Longitudinal Internet studies for the Social Sciences (LISS) panel (Scherpenzeel and Das, 2011). This panel is based on a traditional probability sample drawn from the Dutch population register by Statistics Netherlands and administered by Centerdata. Individuals who do not speak Dutch and individuals younger than 16 years old are excluded and people cannot register themselves to become a respondent for the LISS panel. The initial set-up was funded by the Dutch Research Council (NWO). Panel members receive an incentive of 15 euros per hour and members who do not have a computer and/or internet access are provided with the necessary equipment at home (for further information about the LISS panel, all conducted studies since 2007, and open access data see: <https://www.dataarchive.lissdata.nl>; in English). Centerdata received the CoreTrustSeal certification for the LISS Data Archive, based on the World Data System (WDS) of the International Science Council and the Data Seal of Approval (DSA) catalogue and procedures. As described above, this panel was also used in earlier mental health-related COVID-19 studies (Van Tilburg et al., 2020; van der Velden et al., 2020, 2021, 2022a, 2022b, 2022c).

We focused on adult respondents of 18 years and older who participated in the following surveys: three surveys of the VICTIMS-study (March–April 2019, T1, response = 83.2 %; March–April 2020, T3, response = 83.6 %, and March–April 2021, T5, 86.7 %), and three surveys of the yearly HEALTH survey (health module in the LISS Core Study: November–December 2019, T2, response = 86.4 %; November–December 2020, T4, response = 83.6 %; November–December 2021, T6, response = 81.2 %), resulting in 2 pre-outbreak surveys (T1 and T2) and 4 post-outbreak (T3, T4, T5, and T6).

In total, 5114 adult panel members with ADS data participated in the first survey of this study (March–April 2019), of which 3493 participated in all 6 surveys (response = 68.3 %). Multivariate logistic regression analyses with the non-response as dependent variable showed that males, unmarried, and younger respondents significantly less often participated in all 6 surveys than females, married, and older respondents respectively (all $p < 0.001$). ADS and education level were not significantly associated with the non-response. To optimize the representativeness of the study sample, we weighted the data using 16 exclusive demographic profiles among the total adult Dutch population based on the open access data of Statistics Netherlands (see: <https://opendata.cbs.nl/#/CBS/en/>). These profiles were constructed using the variables sex (male, female), age (18–34, 35–49, 50–64, 65 years and older), and marital status (married and unmarried). All results are based on the weighted data.

2.2. Approval and consent

In accordance with the General Data Protection Regulation (GDPR), participants gave explicit digital consent for the use of the collected data for scientific and policy relevant research. The VICTIMS-study and questionnaire was approved by an Internal Review Board of Centerdata, consisting of independent, internal and external reviewers. These reviewers were not involved in the development of the VICTIMS-study. The HEALTH survey was evaluated and approved by an independent Board of Overseers, an IRB of Centerdata until 2014. Since our research did not impose a certain behaviour, our research did not need the approval of a Dutch Medical Ethical Testing committee according to Dutch Law. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

2.3. Measures

Background characteristics such as gender, age, primary occupation (employed, student, (partial) work disabled), and composition of household (in particular children at home) were assessed in all surveys.

Anxiety and depression symptoms were examined using the 5-item Mental Health Index or Inventory (MHI-5; Means-Christensen et al., 2005; Ware and Sherbourne, 1992). The MHI-5 asks respondents to rate their mental health during the past month on 6-point Likert scales, such as ‘This past month I felt very anxious’ and ‘I felt depressed and gloomy’ (0 = never to 5 = continuously). After recoding the three negative formulated items, the total scores were computed and multiplied by four (to arrive at a 0–100 scale). Lower scores indicate more anxiety and depression symptom levels (all Cronbachs Alpha’s ≥ 0.86). We used two cut-off scores (Perenboom et al., 2000): ≤ 60 for the prevalence of moderate-very severe symptom levels (abbreviated as moderate symptoms levels) and ≤ 44 for the prevalence of severe-very severe symptom (sub)-clinical levels (abbreviated as severe symptoms levels). The cut-offs were determined using the data of the Composite International Diagnostic Interview (CIDI) conducted among a large probability sample of the Dutch population (Perenboom et al., 2000).

2.4. Data analyses

The subsamples employed, employed with children at home, and (partially) work disabled, consisted of respondents who had the corresponding characteristic at all six surveys, such as that the subgroup of employed respondents was employed at all six surveys. The subgroup of young adults consisted of respondents who were 18–24 years old in March 2019.

To examine if the prevalence of moderate anxiety and depression symptoms (ADS) after the outbreak differed from the prevalence before the outbreak, a series of generalized estimating equations (GEE) for longitudinal ordinal data were conducted (GENLIN in SPSS version 28, using an autoregressive working correlation structure). As described, three surveys were conducted in March–April and three in November–December. To control for possible seasonal effects, we a.) compared the prevalence of moderate ADS in March–April 2020 (T3) and March–April 2021 (T5) with the prevalence of moderate pre-outbreak ADS in March–April 2019 (T1), and b.) compared the prevalence of post-outbreak moderate ADS in November–December 2020 and November–December 2021 with the prevalence of pre-outbreak moderate ADS in November–December 2019 (T2). Differences in the prevalence of severe ADS were analysed in a similar way.

We furthermore distinguished persistent (during 8 months) and chronic (during 12 months) ADS. The prevalence of persistent moderate ADS at T2, at T4 and at T6 were computed by counting the number of respondents that suffered from moderate ADS at T1 and T2, at T3 and T4, and at T5 and T6 respectively, divided by the total number of respondents, resulting in one pre-outbreak prevalence of persistent moderate ADS and two post-outbreak prevalence of persistent moderate ADS. The prevalence of chronic moderate ADS at T3 and T5 were computed by counting the number of respondents that suffered from moderate ADS at a.) T1, T2, and T3, and b.) at T3, T4, and T5 respectively, resulting in one pre-outbreak prevalence of chronic ADS and one post-outbreak prevalence of chronic ADS. Series of GEE were used to examine if the prevalence of persistent moderate and severe ADS, and chronic moderate and severe ADS after the outbreak differed from before the outbreak. Because of the number of comparisons (84 in total) the Benjamini-Hochberg p -value correction for multiple testing was applied (Benjamini and Hochberg, 1995).

The analyses were performed for each subgroup separately because not all subgroups were mutually exclusive.

Table 1
Characteristics of study samples in March 2019.

	General adult population (N = 3493)	Employed (N = 1652) ¹	Employed with children at home (N = 640) ¹	Young adults (N = 336)	(partial) Work disabled (N = 122) ¹	Non-western ethnic minorities (N = 301) ²
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Sex						
- Male	1721 (49.3)	923 (55.9)	369 (57.6)	168 (50.1)	50 (40.8)	164 (54.4)
- Female	1772 (50.7)	729 (44.1)	271 (42.4)	168 (49.9)	73 (59.2)	137 (45.6)
Age						
- 18-34 years	931 (26.7)	493 (29.8)	142 (22.2)	336 (100.0)	17 (14.1)	130 (43.1)
- 35-49 years	826 (23.6)	630 (38.1)	331 (51.8)	–	39 (31.9)	99 (32.8)
- 50-64 years	904 (25.9)	510 (30.9)	165 (25.8)	–	66 (53.6)	53 (17.7)
- 65 years or older	832 (23.8)	19 (1.2)	1 (0.2)	–	1 (0.5)	19 (6.3)
Education						
- Low	859 (24.6)	233 (14.1)	93 (14.5)	90 (26.7)	41 (33.1)	85 (28.3)
- Medium	1280 (36.6)	595 (36.0)	236 (36.9)	181 (54.0)	59 (48.0)	105 (34.9)
- High	1354 (38.8)	824 (49.9)	311 (48.6)	65 (19.3)	23 (18.9)	111 (36.9)
Marital status						
- Married	1682 (48.2)	807 (48.8)	457 (71.5)	6 (1.8)	52 (42.1)	112 (37.3)
- Unmarried	1811 (51.8)	846 (51.2)	183 (28.5)	330 (98.2)	71 (57.9)	189 (62.7)

Due to weighting numbers may slightly differ.

¹ At all surveys (T1 to T6).

² First generation foreign, non-western background or second generation foreign, non-western background.

3. Results

3.1. Characteristics of study samples

The characteristics of the six study samples are presented in Table 1. Because the groups are not fully mutually exclusive, differences in characteristics were not examined.

3.2. Prevalence of anxiety and depression symptoms

Table 2 shows that among the general population moderate ADS was more prevalent at T3 than at T1 (OR = 1.09, 95 % CI = 1.01–1.17, $p = 0.025$) while severe ADS was more prevalent at T1 than at T3 (OR = 0.84, 95 % CI = 0.73–0.96, $p = 0.013$). Among employed with children at home, moderate ADS at T4 was less prevalent than at T2 (OR = 0.78,

Table 2
The prevalence of moderate and severe anxiety and depression symptoms among the general population and subgroups.

	T1	T2	T3	T4	T5	T6	Differences similar period before-after outbreak ⁴
	Mar-Apr 2019	Nov-Dec 2019	Mar-Apr 2020	Nov-Dec 2020	Mar-Apr 2021	Nov-Dec 2021	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
General adult population (N = 3493)							
- Moderate	764 (21.9)	733 (21.0)	813 (23.3)	753 (21.6)	770 (22.0)	727 (20.8)	T1 < T3, T1 = T5
- Severe	239 (6.8)	228 (6.5)	203 (5.8)	213 (6.1)	225 (6.4)	208 (6.0)	T1 > T3, T1 = T5
Employed (N = 1653)¹							
- Moderate	319 (19.3)	304 (18.4)	345 (20.9)	313 (18.9)	324 (19.6)	308 (18.6)	T1 = T3, T5
- Severe	75 (4.6)	73 (4.4)	57 (3.5)	80 (4.9)	78 (4.7)	77 (4.6)	T2 = T4, T6
Employed and children at home (N = 640)¹							
- Moderate	116 (18.1)	124 (19.3)	127 (19.8)	100 (15.6)	131 (20.4)	124 (19.5)	T1 = T3, T5
- Severe	28 (4.4)	30 (4.6)	25 (3.8)	29 (4.5)	28 (4.4)	30 (4.7)	T2 > T4, T2 = T6
(partial) Work disabled, (N = 122)¹							
- Moderate	69 (56.2)	59 (48.2)	61 (49.9)	59 (48.4)	58 (47.6)	63 (51.6)	T1 > T3, T5
- Severe	35 (28.9)	32 (26.5)	30 (24.2)	25 (20.4)	29 (23.6)	30 (24.4)	T2 = T4, T6
Young adults (N = 336)²							
- Moderate	108 (32.1)	109 (32.6)	117 (34.9)	109 (32.6)	119 (35.4)	102 (30.2)	T1 = T3, T5
- Severe	52 (15.6)	39 (11.6)	40 (11.9)	33 (9.8)	43 (12.8)	34 (10.2)	T1 > T3, T1 = T5
Non-western ethnic minorities (N = 301)³							
- Moderate	112 (37.3)	110 (36.6)	121 (40.1)	110 (36.7)	114 (37.8)	104 (34.6)	T1 = T3, T5
- Severe	31 (10.2)	37 (12.2)	35 (11.6)	36 (12.1)	40 (13.4)	26 (8.6)	T2 = T4, T6

Note. Mar-Apr = March–April. Nov-Dec = November–December. Moderate = scores on MHI-5 of 60 or lower. Severe = scores on MHI-5 of 44 or lower. T1 was compared with T3 and T5, T2 was compared with T4 and T6. Due to weighting numbers may slightly differ. “X = Y” = no significant difference between X and Y. “X < Y” = X is significant smaller than Y. “X > Y” = X is significant larger than Y.

¹ At all surveys (T1 to T6).

² 18–24 years old at T1.

³ First generation foreign, non-western background or second generation foreign, non-western background.

⁴ Before the Benjamini-Hochberg correction.

Table 3
Persistent moderate and severe anxiety and depression symptoms among the general population and subgroups.

	T1	T2	T3	T4	T5	T6	Differences similar period before-after outbreak ⁴
	Mar-Apr 2019	Nov-Dec 2019	Mar-Apr 2020	Nov-Dec 2020	Mar-Apr 2021	Nov-Dec 2021	
		N (%)		N (%)		N (%)	
		T1-T2		T3-T4		T5-T6	
General adult population (N = 3493)							
- Moderate		493 (14.1)		499 (14.3)		506 (14.5)	T2 = T4,T6
- Severe		119 (3.4)		95 (2.7)		114 (3.3)	T2 > T4,T2 = T6
Employed (N = 1653) ¹							
- Moderate		191 (11.6)		182 (11.0)		209 (12.7)	T2 = T4,T6
- Severe		23 (1.4)		22 (1.3)		37 (2.3)	T2 < T6,T4 = T2
Employed and children at home (N = 640) ¹							
- Moderate		73 (11.5)		65 (10.1)		90 (14.3)	T2 = T4,T6
- Severe		7 (1.1)		12 (1.9)		16 (2.5)	T2 < T6,T2 = T4
(partial) Work disabled, (N = 122) ¹							
- Moderate		56 (45.9)		52 (42.4)		51 (41.9)	T2 = T4,T6
- Severe		25 (20.4)		19 (15.9)		22 (17.7)	T2 = T4,T6
Young adults (N = 336) ²							
- Moderate		73 (21.9)		80 (24.0)		67 (20.0)	T2 < T4,T2 = T6
- Severe		27 (8.1)		16 (4.7)		18 (5.3)	T2 > T4,T2 = T6
Non-western ethnic minorities (N = 301) ³							
- Moderate		82 (27.2)		80 (26.7)		80 (26.7)	T2 = T4,T6
- Severe		15 (5.0)		18 (6.0)		21 (6.9)	T2 = T4,T6

Note. Mar-Apr = March–April. Nov-Dec = November–December. Moderate = scores on MHI-5 of 60 or lower. Severe = scores on MHI-5 of 44 or lower. T1-T2 was compared with T3-T4 and T5-T6. Due to weighting numbers may slightly differ. “X = Y” = no significant difference between X and Y. “X < Y” = X is significant smaller than Y. “X > Y” = X is significant larger than Y.

¹ At all surveys (T1 to T6).

² 18–24 years old at T1.

³ First generation foreign, non-western background or second generation foreign, non-western background.

⁴ Before the Benjamini-Hochberg correction.

CI = 0.64–0.95, $p = 0.013$).

Among work disabled the prevalence of moderate ADS at T1 was higher than at T3 (OR = 0.74, 95 % CI = 0.57–0.97, $p = 0.029$) and at T5 (OR = 0.68, 95 % CI = 0.48–0.96, $p = 0.029$), but the difference in severe ADS between T2 and T4 did not reach the $p < 0.05$ significant level ($p = 0.055$). Table 2 furthermore shows that among young adults the prevalence of severe ADS at T3 was lower than at T1 (OR = 0.72, 95 % CI = 0.53–0.97, $p = 0.032$). No other significant differences ($p < 0.05$) were observed within the general population and subgroups.

After the Benjamini-Hochberg correction for multiple comparisons (48) none of the six p -values was lower than the computed criterion p -values.

3.3. Persistent of anxiety and depression symptoms

The results with respect to persistent symptoms are presented in Table 3. It shows that among the general population the prevalence of persistent severe ADS after the outbreak at T4 was lower than at T2 (OR = 0.79, 95 % CI = 0.66–0.94, $p = 0.007$). Among employed and employed with children at home, persistent severe ADS was more prevalent after the outbreak (T6) than before (T2, OR = 1.64, 95 % CI = 1.02–2.63, $p = 0.040$ and OR = 2.47, 95 % = 1.15–5.31, $p = 0.021$ respectively). Among young adults a lower prevalence of persistent severe ADS at T4 than at T2 was found (OR = 0.56, 95 % = 0.36–0.84, $p = 0.006$). No other significant differences within the groups were found. After the Benjamini-Hochberg correction none of four p -values was lower than the computed criterion p -values.

3.4. Chronic persistent of anxiety and depression symptoms

Table 4 shows that chronic moderate ADS among the general population was more prevalent after (T5) than before the outbreak (T3; OR

= 1.11, 95 % CI = 1.05–1.18, $p < 0.001$). Among youngsters a similar pattern was found (OR = 1.35, 95 % CI = 1.10–1.65, $p = 0.004$). No other significant differences with the groups were found. After the Benjamini-Hochberg correction the significant differences remained significant.

4. Discussion

The aim of the present study was to examine to what extent adults more often suffer from a.) moderate and severe anxiety and depression symptoms (ADS) and b.) persistent and chronic moderate and severe ADS since the post-COVID-19 outbreak until November–December 2021, compared to similar periods before the outbreak. We examined differences in post- and pre-outbreak prevalence among the adult general population and among relevant subgroups separately (young adults, employed, employed with children at home, (partially) work disabled and non-western, ethnic minorities).

With respect to the Dutch general population, no indications were found that mental health was profoundly negatively affected by the COVID-19 pandemic until November–December 2021 despite all disruptions. We found several significant but minor fluctuations: a small decrease of severe ADS in March–April 2020, a very small decrease in persistent severe ADS in November–December 2020, and a very small increase in chronic moderate ADS in March–April 2021. After the Benjamini-Hochberg correction only two of the twelve comparisons remained significant under the corrected p -value. Similar to the study of Knudsen et al. (2021) among the Norwegian general population, the prevalence of assessed mental health problems appears to be rather stable among the Dutch adult general population (cf. Kok et al., 2022; Van Tilburg et al., 2020; Van der Velden et al., 2020, 2021, 2022b). With respect to the first-year post-outbreak, our findings seem to differ to some extent from the findings in other countries such as the UK and USA

Table 4
Chronic moderate and severe anxiety and depression symptoms among the general population and subgroups.

	T1	T2	T3	T4	T5	Differences similar period before-after outbreak ⁴
	Mar-Apr 2019	Nov-Dec 2019	Mar-Apr 2020	Nov-Dec 2020	Mar-Apr 2021	
	N (%)	N (%)	N (%)	N (%)	N (%)	
	T1-T2-T3			T3-T4-T5		
General adult population (N = 3493)						
- Moderate			382 (10.9)		416 (11.9)	T3 < T5
- Severe			74 (2.1)		70 (2.0)	T3 = T5
Employed (N = 1653) ¹						
- Moderate			144 (8.7)		146 (8.9)	T3 = T5
- Severe			13 (0.8)		16 (1.0)	T3 = T5
Employed and children at home (N = 640) ¹						
- Moderate			52 (8.2)		56 (8.8)	T3 = T5
- Severe			5 (0.8)		11 (1.6)	T3 = T5
(partial) Work disabled, (N = 122) ¹						
- Moderate			49 (39.9)		48 (38.8)	T3 = T5
- Severe			17 (14.0)		16 (12.9)	T3 = T5
Young adults (N = 336) ²						
- Moderate			56 (16.7)		72 (21.4)	T3 < T5
- Severe			14 (4.2)		14 (4.2)	T3 = T5
Non-western ethnic minorities (N = 301) ³						
- Moderate			71 (23.7)		66 (22.0)	T3 = T5
- Severe			10 (3.2)		12 (3.9)	T3 = T5

Note. Mar-Apr = March–April. Nov-Dec = November–December. Moderate = scores on MHI-5 of 60 or lower. Severe = scores on MHI-5 of 44 or lower. T1-T2-T3 was compared with T3-T4-T5. Due to weighting numbers may slightly differ. “X = Y” = no significant difference between X and Y. “X < Y” = X is significant smaller than Y. “X > Y” = X is significant larger than Y.

¹ At all surveys (T1 to T6).

² 18–24 years old at T1.

³ First generation foreign, non-western background or second generation foreign, non-western background.

⁴ Before the Benjamini-Hochberg correction.

(cf. Robinson et al., 2022; Kessler et al., 2022). Importantly, in their meta-analyses, Robinson et al. (2022) concluded “Findings confirm that the initial outbreak of the pandemic was associated with a significant but statistically small increase in mental health symptoms”. However, as mentioned previously (Van der Velden et al., 2021), this pandemic did not occur in a vacuum. Before and during this pandemic, both the UK and USA faced (serious) political and societal tensions due to Brexit and presidential elections, respectively. These special circumstances may have fostered uncertainties and conflicts, increasing the risk for mental health problems during this pandemic.

In either case, our findings and the findings of other prospective studies show that the effects of the COVID-19 pandemic on the mental health of the general adult population are less alarming than initially expected (cf. Pfefferbaum and North, 2020). As clarified by Kessler et al. (2022), many cross-sectional studies among the general population during the first months of the pandemic reported high levels of mental health problems, but they were based on nonprobability or convenience (opt-in) samples, lacked pre-outbreak data on mental health, and therefore had a high risk of overestimating the effects of the pandemic (cf. Bradley et al., 2021; Kessler et al., 2022). Despite the methodological limitations of these studies, they may have fuelled ideas and expectations about the effects of the pandemic on the mental health of the general population. However, an increase of chronic moderate ADS among 18–24 old respondents was observed despite the absence of an increase in the point prevalence of moderate ADS in the months after the outbreak compared to before the outbreak. This suggests that due to the pandemic young adults recovered less from earlier moderate ADS and may need special attention.

In contrast to Steptoe and Di Gessa (2021), but generally in line with Davis et al. (2021) and Altieri et al. (2022), no increase of ADS among (partial) work disabled was found.

We are not aware of population-based prospective studies that systematically examined the prevalence of pre- and post-outbreak

persistent and chronic moderate and severe ADS during the year before and almost two years after the COVID-19 outbreak to compare our findings with.

4.1. Strengths and limitations

The prospective study design with non-retrospective pre-COVID-19 outbreak data on anxiety and depression symptoms (ADS), the use of a well-validated instrument to examine ADS, the use of a representative study sample based on a traditional probability sample of the Dutch population, applying the Benjamini-Hochberg correction for multiple testing, assessing the course of ADS within the general population as well as within specific subgroups, the high response rates, and comparisons of the prevalence of ADS, and persistent and chronic ADS after the outbreak with the prevalence in the same periods before the outbreak are major methodological strengths of the present study. We examined differences between the post- and pre-outbreak prevalence of ADS using cut-off scores for moderate ADS and severe ADS, but did not conduct clinical interviews to examine generalized anxiety, major depression, or other common mental health disorders. ADS was assessed by a standardized and frequently used self-report questionnaire. Although we consider it unlikely that substantial differences in the prevalence of pre- and post-outbreak (persistent and chronic) generalized anxiety and major depression disorders exist where we did not find significant differences within the general population and subgroups, we cannot rule out this possibility. In the present study we focused of the prevalence of moderate persistent and chronic ADS. The absence of differences in the prevalence of ADS does not rule out the possibility that mean scores (slightly) differ after the outbreak compared to before the outbreak.

This study was conducted in a relatively rich Western country with relatively generous social welfare arrangements and opportunities for economic compensation for COVID-19 related losses (Kok et al., 2022;

Van der Velden et al., 2021). In the Netherlands, people do not lose health insurance when becoming unemployed. It is unclear to what extent the current findings can be generalized to adults in countries with fewer or no supporting arrangements (cf. Chen et al., 2022; Tran et al., 2022) and to other specific subgroups of adults within the general population such as COVID-19 patients (cf. Gramaglia et al., 2022; Ma et al., 2022b; Yang et al., 2022). A previous longitudinal study using the LISS panel showed that adults exposed to potentially traumatic events (e.g. crime, accidents) during the first year after the outbreak more often suffered from ADS and probable PTSD than adults exposed to these events in a similar period before the outbreak (Van der Velden et al., 2022c). We did not include a subgroup of students (cf. McLafferty et al., 2021; Voltmer et al., 2021) in the analyses because of the 3-year time-frame in which many students, who started their study before 2019, will have finished their study at the end of 2021 therefore requiring another research design.

4.2. Final remarks

Current findings on the differences and similarities between the pre- and post-outbreak prevalence of moderate and severe persistent and chronic ADS up to December 2021 within the Dutch general population and within employed, employed with children at home, young adults, non-western, ethnic minorities and (partially) work disabled, contain important lessons for the future. In the Netherlands, there has not been a general mental health crisis during this pandemic. The initial fear for this, insufficiently took into account aspects such as the resilience of the general population, possible positive effects of preventive measures and existing social welfare arrangements. Other prospective studies showed similar findings in, for example, Norway and the UK. Nevertheless, for many countries with possibly very different circumstances, it is unfortunately unknown to what extent the fear of a mental health crisis is proven right or wrong. This disruptive global pandemic did, despite all immense negative consequences, not occur in a vacuum. As noted by Dévora Kestel, Director of the Department of Mental Health and Substance Use at WHO “While the pandemic has generated interest in and concern for mental health, it has also revealed historical under-investment in mental health services” (WHO, 2022b). In addition, as is also shown in the present study, there are individuals that suffer from this pandemic to a larger extent and for a longer period of time than others. Measures must be taken to prevent that, due to new political and societal crises, such as the war in Ukraine, attention for these problems fades away. Finally, a very large number of studies (see introduction) on the effects of this pandemic on the mental health used cross-sectional study designs that were often based on convenience samples. For instance, of the 341 studies in developing countries that Chen et al. (2022) included in their review and meta-analysis, 96.48 % were cross-sectional surveys. In future pandemics, much progress can be gained by increasing the number of methodological sound longitudinal (prospective) cohort studies and minimizing the number of cross-sectional surveys without pre-outbreak reference data.

Role of the funding source

One co-author (CC) is the deputy director of the Victims Support Foundation, the sponsor of the VICTIMS-study. All authors had complete freedom to direct the analyses and its reporting without influence from the sponsor. There was no editorial direction or censorship from the sponsor.

CRedit authorship contribution statement

Peter G. van der Velden: Conceptualization, Visualization, Formal analysis, Methodology, Data curation, Writing – original draft, Writing – review & editing. Carlo Contino: Conceptualization, Visualization, Writing – review & editing. Lars de Vroege: Conceptualization,

Visualization, Methodology, Data curation, Writing – review & editing. Marcel Das: Conceptualization, Visualization, Methodology, Writing – review & editing. Mark Bosmans: Conceptualization, Visualization, Writing – review & editing. Josjan Zijlmans: Conceptualization, Visualization, Methodology, Writing – review & editing.

Declaration of competing interest

There are no conflicts of interest in relation to this article.

Acknowledgments

We thank the members of the LISS panel for their time and effort. This work was supported by Fonds Slachtofferhulp, The Hague, The Netherlands (50006/VICTIMS).

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