












RESEARCH ARTICLE

Open Access



Meaningful activities during COVID-19 lockdown and association with mental health in Belgian adults

Ellen Cruyt¹ , Patricia De Vriendt^{1,2,3} , Miet De Letter¹ , Peter Vlerick⁴ , Patrick Calders¹ , Robby De Pauw¹ , Kristine Oostra¹ , Maria Rodriguez-Bailón⁵ , Arnaud Szmalec^{6,7}, Jose Antonio Merchán-Baeza⁸ , Ana Judit Fernández-Solano⁹ , Laura Vidaña-Moya¹⁰ and Dominique Van de Velde^{1*} 

Abstract

Background: The spread of COVID-19 has affected people's daily lives, and the lockdown may have led to a disruption of daily activities and a decrease of people's mental health.

Aim: To identify correlates of adults' mental health during the COVID-19 lockdown in Belgium and to assess the role of meaningful activities in particular.

Methods: A cross-sectional web survey for assessing mental health (General Health Questionnaire), resilience (Connor-Davidson Resilience Scale), meaning in activities (Engagement in Meaningful Activities Survey), and demographics was conducted during the first Belgian lockdown between April 24 and May 4, 2020. The lockdown consisted of closing schools, non-essential shops, and recreational settings, employees worked from home or were technically unemployed, and it was forbidden to undertake social activities. Every adult who had access to the internet and lived in Belgium could participate in the survey; respondents were recruited online through social media and e-mails. Hierarchical linear regression was used to identify key correlates.

Results: Participants ($N = 1781$) reported low mental health ($M = 14.85/36$). In total, 42.4% of the variance in mental health could be explained by variables such as gender, having children, living space, marital status, health condition, and resilience ($\beta = -.33$). Loss of meaningful activities was strongly related to mental health ($\beta = -.36$) and explained 9% incremental variance (R^2 change = .092, $p < .001$) above control variables.

Conclusions: The extent of performing meaningful activities during the COVID-19 lockdown in Belgium was positively related to adults' mental health. Insights from this study can be taken into account during future lockdown measures in case of pandemics.

Keywords: Corona, General health, Meaningful activities, Occupations, Resilience, Well-being

* Correspondence: Dominique.vandevelde@ugent.be

¹Faculty of Medicine and Health Sciences, Department of Rehabilitation Sciences, Occupational Therapy, Physiotherapy and Speech-language Pathology/Audiology, Ghent University, Corneel Heymanslaan 10, B3, entrance 46, 9000 Ghent, Belgium

Full list of author information is available at the end of the article



© The Author(s). 2021, corrected publication 2021. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Background

Coronavirus disease 19 (COVID-19) is a novel infectious disease with an onset in Wuhan City, China, in December 2019 [1]. Since then, COVID-19 has become a pandemic and can cause a severe acute respiratory syndrome that can lead to death [2]. The World Health Organization (WHO) declared the COVID-19 outbreak as a public health emergency of international concern [3]. Governments around the globe implemented highly restrictive, sometimes intrusive measures under rapidly changing epidemiological situations [4].

Epidemic diseases are a permanent threat to global health. Nowadays, many infections such as smallpox and influenza can be prevented by vaccinations, and COVID-19 is not the first epidemic to affect Belgium. In the past, Europe, including Belgium had to deal with (Mexican) influenza, smallpox, and the Black Plague. In recent decades, Belgium was spared life-threatening epidemics such as Severe Acute Respiratory Syndrome (SARS) in 2003, which had very similar symptoms of COVID-19 [5]. This is therefore the first time the majority of the Belgian population has experienced something so manifest and profound.

On March 13, 2020, a lockdown in Belgium was a necessary preventive action to avert the threat of a health crisis [6]. Despite this lockdown in the month of June, 2020, more than 15,000 COVID-19 related deaths were reported for Belgium's population of about 11 million people, that is, 174 deaths per day per million inhabitants (data retrieved on the first of August, 2020) [7].

Research has shown that epidemics can cause severe and variable psychological effects on people [8, 9]. The growing literature on COVID-19 has already shown that the pandemic and accompanying measures have had a profound effect on—besides health issues—all aspects of society, including mental health [10, 11]. Because mental health under COVID-19 is now among the foremost public health concerns throughout the world, it is also one of the most researched topics [12]. Most of the mental health-related studies during COVID-19 focused on caregivers, such as nurses and physicians, who are on the frontlines of the pandemic responses [13–17] or considered the mental health of COVID-19 patients [18].

COVID-19 and mental health is, to date, a rapidly growing field of research. The results are fragmented and a clear picture is still missing. Several mental health studies on COVID-19 found associations between demographic characteristics and mental health. It seems that younger people (< 30 years, inclusive of students [19, 20]) [13, 21–25]; women [9, 13, 19, 20, 22, 26]; health-care workers [13, 21]; unemployed people [19]; adults who have children [27, 28]; people living in rural areas [29]; those having cancer or chronic diseases [23]; those living with family member at high risk for COVID-19

[9]; and those living alone [23] have the highest risk to develop mental health problems such as anxiety or depression during the COVID-19 crisis.

So far none of these studies on mental health during COVID-19 took the role or potential influence of one's daily meaningful activities on adult mental health into account, although the lockdown has had a major impact on daily activities [30] and previous research has shown that daily activities can have a huge impact on one's mental health [31–36].

Activity engagement has also been associated with lower levels of mental health symptoms due to the meaning people attribute to their daily activities [37–41]. Indeed, activity engagement contributes strongly to humans' sense of purpose in life and fulfilment of psychological basic needs (e.g. need for autonomy, need to belong, and need for competence) leading to better health [42], well-being [43, 44], and successful aging [45–47]. This suggests that the COVID-19 lockdown and the implied immediate and unprecedented impact on multiple facets of life might influence one's mental health due to a diminished sense of purpose and/or frustration of these psychological needs. This may be especially true for adults who are undergoing a critical time of interpersonal development, education, family development, and career building. For instance, young adults are at high risk for mental health problems as they reported elevated loneliness and depression even after the first 5 months of exposure to the COVID-19 pandemic [22].

Considering the relevance of meaningful activities for mental health, it can be concluded that there is a gap in the COVID-19 literature about the relationship between mental health and meaningful activities during lockdown. This study therefore examined whether meaning in activities was associated with mental health, regardless of demographic and personal characteristics (e.g., resilience).

The hypothesis (H) of this study was that the inability to engage in meaningful activities during COVID-19 lockdown would be a contributing factor for low mental health. Specifically, we expected a positive association between engaging in meaningful activities and mental health in adults, even after taking control variables into account.

Materials and methods

Study design

A cross-sectional online survey was conducted among a sample of adults in Belgium, via the online platform Limesurvey©. The study adhered to the strengthening of the reporting of observational studies in epidemiology (STROBE) statement [48].

Procedure and participants

The first lockdown measures in Belgium began on March 13, 2020, comprising the following restrictions: (1) primary schools, Universities of Applied Sciences, and Universities had to close and turned digital; (2) all not-essential shops had to close, and only food-related shops were permitted to be open; (3) businesses had to close and employees became technically unemployed or had to work from home; (4) planned activities such as concerts and, sports events were cancelled; (5) recreational settings such as cinemas and, fitness centers, had to close; and (6) it was forbidden to see family and friends outside one's own house and to undertake social activities. These measures lasted until May 4, 2020, when the number of COVID-19 infections stabilized.

The web-based self-reported questionnaire was distributed online in Belgium (Flanders and Wallonia) between April 24 (6 weeks after elapsing the total lockdown) and May 4, 2020. The data collection stopped after the government introduced a reduction in the measures with a gradual start-up of work, shops, and schools.

Participants were recruited through online communications on social media (Facebook, e-mails, Twitter, and LinkedIn) and through e-mails (sent to the authors' networks, patient associations, colleges, and universities).

To capture the entire lifespan of adulthood, every adult, aged 18 years or older, who had access to the internet and lived in Belgium, could voluntarily and anonymously participate in the study. Participants under the age of 18 were excluded because they are too young to answer the survey questions properly and are still dependents on their parents.

Measures

Three standardized and validated measurement instruments were integrated into the online questionnaire and supplemented by additional questions to describe the study sample.

Part 1: Sociodemographic and activity related data

The first part of the online questionnaire included operationalizations of the following descriptive variables: age, gender, educational level, marital status, having children, employment status (with working situation), living situation, living region, living area, living space, health condition, and whether the participants were informal caregivers or receiving informal care.

Next, participants were presented a fixed list of 18 daily activities. These activities were relevant across all stages of adulthood and were identified through a literature study including basal, instrumental, and advanced activities of daily living. A consensus was made based on the expertise of the research team, and the activities were linked to the nine domains of the International

Classification of Functioning and Disability and Health (ICF) [49].

Participants were asked to indicate whether or not they performed each of these daily activities before the COVID-19 crisis. If so, they had to indicate whether they adapted the activity during COVID-19. Four category options were provided: (1) as usual (in the same manner compared to before the COVID-19 crisis); (2) in another environment (e.g., at home instead of the office); (3) in another way (e.g., online shopping instead of shopping in the street); and (4) another activity evoking the same purpose or meaning (e.g., going for a walk instead of going to the gym). Selecting one or more categories was possible.

Part 2: instruments

The general health questionnaire (GHQ) Participants' mental health was assessed using the 12-item version of the GHQ, which is a valid and reliable instrument for assessing psychological morbidity and distress [50]. This widespread validated instrument is used by the government in (epidemiological) studies in Belgium [51–53]. It had a sensitivity of 83.4% and specificity of 76.3% [54]. Internal consistency of the GHQ in this study sample was calculated with the Cronbach's Alpha. Every item (e.g., *Lately, have you lose much sleep over worry?*) has four answer options using a Likert scale (0= 'not at all'; 1= 'no more than usual'; 2= 'rather more than usual'; or 3= 'much more than usual'). The total sum scores can range from 0 to 36, with higher total scores reflecting higher levels of psychological morbidity or distress. A score of 12 or lower in adults indicates psychological well-being [54].

The Connor-Davidson resilience scale (CD-RISC)

The CD-RISC measures the personal characteristic of resilience, broadly conceptualized as healthy and adaptive functioning in the aftermath of adversity [55, 56]. The 10-item CD-RISC (e.g., *'I am able to adapt when changes occur'*) is scored on a 5-point Likert scale ranging from 0= 'not true at all' to 4= 'true nearly all of the time'. The total sum score ranges from 0 to 40. A higher score indicates higher resilience [57]. The CD-RISC is a widely recognized and well-validated measurement of resilience in different cultures [58] and populations [59]. In adults, the threshold score is 29 [60]. It showed a good convergent validity, accounted for high explained variance (81.5%), and overall correlation values on divergent validity were close to zero [61]. Internal consistency of the CD-RISC in this study sample was calculated with Cronbach's Alpha.

The engagement in meaningful activities survey (EMAS) The 12-item EMAS with 4-point Likert scale according to Eakman [62] was used. This measure was developed to assess aspects of activity meaning and emphasizes activity's congruity with one's value system and its ability to fulfill basic needs and mastery. The EMAS uses the broad term 'activities' to represent typical activities within self-care, leisure, and productivity. Participants were asked to rate each statement (e.g. '*The activities I do reflect the kind of person I am*') on a 4-point Likert scale, ranging from 1 = 'seldom' to 4 = 'always'. A total sum score ranges from 12 to 48. The meaningfulness of a person's activities can be either low (EMAS < 29), moderate (EMAS 29–41), or high (EMAS > 41). The EMAS was found to have adequate test-retest reliability ($r = .71$) and significant positive correlations and negative zero-order correlations with measures of meaning and purpose in life, depressive symptomology, life satisfaction, and health-related quality of life [50, 63]. Internal consistency of the EMAS in this study sample was calculated with Cronbach's Alpha.

Data analysis

Only full completed questionnaires were used for statistical analyses. All statistics were performed using SPSS 26 (SPSS Inc., Chicago, IL) and a $p < .05$ was considered significant in all analyses. A descriptive analysis (frequencies and means) of the sample (demographics and activities during COVID-19) was conducted.

Step 1: bivariate analysis

In preparation for the multivariate analysis and to identify significant correlates of mental health, all potential relevant variables retrieved from the survey were associated with mental health. Bivariate analysis through between-group differences in mental health (GHQ) regarding nominal and ordinal independent variables was evaluated by Mann–Whitney U tests for questions with two answer categories (gender, having children, living area, informal caregiver, receiving care, living space) and Kruskal–Wallis tests for questions with more than two answer categories (marital status, educational level, employment status, living condition, region, working situation, health condition). Mann–Whitney U tests were conducted after the Kruskal–Wallis tests to find which groups significantly differed from each other based on GHQ scores. Spearman's correlation coefficients were obtained for the continuous independent variables (age, EMAS, and CD-RISC).

Step 2: multivariate analysis

To test the hypothesis, multivariate analysis with hierarchical multiple linear regression was used. All categorical variables with more than two answer categories

were transformed into 'dummy variables'. In Model 1, regression coefficients were calculated for the control variables retrieved from bivariate analysis. The factor 'meaningful activities' was added in Model 2 to examine whether meaningful activities are statistically significantly related to mental health, while adjusting for key confounding variables (demographic and personal characteristics). Models were screened for multicollinearity according to the calculations of the Variance Inflation Factor (VIF). F-values below 0.10 were automatically removed because can be considered insignificant.

Results

Descriptive results

Sociodemographic variables

In total, a convenience sample of 1781 participants completed the questionnaire. Descriptive data for the independent variables are displayed in Table 1.

Activities during the COVID-19 lockdown

An overview of the activities that the participants performed before and during the COVID-19 crisis can be found in Table 2. Thirty-seven percent of the respondents who indicated that they did social activities outside the home before COVID-19 stopped these activities during COVID-19 lockdown. Approximately, two-third of the students who did a student job and nearly 50 % of the adults who volunteered before the COVID-19 crisis had to quit these activities. Activities that continued indoors, alone, or in a 'bubble' with closest family, such as leisure time (97.3%), caring for family (99.4%), household (99.3%), doing chores in the house (98%), and self-care (99.8%), were largely retained.

Table 3 shows whether or not participants adapted their activities during the lockdown according to the four described categories. The activities that were performed in-house during the COVID-19 lockdown were hardly modified. In particular, taking care of themselves (61%) and the family (56%), cooking healthy foods (68%), sexual activity (83%), doing household-related activities (79%), doing chores in the house (61%) and performing student jobs (82%) did not happen any differently than prior to the COVID-19 outbreak.

However, other daily activities such as sports (48%), religion (56%), attending trainings (66%), and going to work (65%) were still performed but largely in a different environment. Adults social outside activities (70%), attending trainings (84%), and caring for others outside the family (55%) were performed in a different manner during COVID-19 lockdown.

Finally, 35% of the participants regularly cared for their health through sports, and 36% of the participants performed social activities prior to the COVID-19 outbreak reported that they replaced these daily activities

Table 1 Overview of sociodemographic characteristics of the study sample (N = 1781)

Mean age (SD)	34.79 (16.8)		
		%	N
Gender	Woman	75.3	1341
	Men	24.7	440
Marital status	Married	27.4	489
	Divorced	2.8	50
	Single	37.4	667
	Widow	1.3	23
	Living together	18.8	335
	Other	12.2	217
Educational level	Elementary school	0.6	10
	Middle school	22.8	406
	University of Applied Sciences and University	76.6	1365
Health condition	Healthy	78	1389
	Acutely ill	2.9	52
	Chronically ill	17.9	318
	Mentally ill	1.2	22
Employment status	Student	45	801
	Employed	37.3	664
	Unemployed	17.7	316
Working situation (if employed)	I work from home	26.1	465
	I work as usual	10.9	195
	Technically unemployed	2.6	47
	Other	4.4	79
Having children	Yes	33.7	601
	No	66.2	1180
Living situation	Living alone	9	160
	Living alone with children	2	35
	Living together without children	23.9	425
	Living together with children	18.5	330
	Living with parents, family	41.7	742
	In a student room alone	0.8	15
	In a dorm with another student	2.3	41
Living region	Flanders (Dutch-speaking part)	94.7	1687
	Wallonia (French-speaking part)	3.2	57
	Brussels	2.1	37
Living area	Urban	42.5	757
	Rural	57.5	1024
Living space	House, apartment with garden or balcony	92.1	1640
	Studio, apartment without balcony	7.9	141
Giving informal care	Yes	9.3	166
	No	90.7	1615
Receiving informal care	Yes	6.1	108
	No	93.9	1673

SD Standard deviation

Table 2 Percentages of participants who discontinued or maintained the selected activities during COVID-19 lockdown

	'Don't do anymore' Participants who discontinued the activities	'Still do' Participants who maintained the activities
Self-care (<i>n</i> = 1754)	0.2%	99.8%
Free time activities indoors (<i>n</i> = 1697)	2.7%	97.3%
Social activities outdoors (<i>n</i> = 1619)	37.4%	62.6%
Household (<i>n</i> = 1616)	0.7%	99.3%
Free time activities outdoors (<i>n</i> = 1473)	17%	83%
Caring for my health through sports (<i>n</i> = 1436)	3.7%	96.3%
Caring for my health through cooking (<i>n</i> = 1351)	2.7%	97.3%
Sexuality (<i>n</i> = 1255)	13.1%	86.9%
Attending a training (<i>n</i> = 945)	4.6%	95.4%
Doing chores in and around the house (<i>n</i> = 841)	2%	98%
Going to work (<i>n</i> = 792)	6.4%	93.6%
Caring for family (<i>n</i> = 515)	0.6%	99.4%
Caring for others outside the family (<i>n</i> = 465)	18.5%	81.5%
Volunteering work (<i>n</i> = 401)	48.9%	51.1%
Caring for my health through mental activities (<i>n</i> = 385)	7%	93%
Student job (<i>n</i> = 326)	68.4%	31.6%
Doing chores for other people (<i>n</i> = 169)	39.6%	60.4%
Religious activities (<i>n</i> = 92)	12%	88%

n = number of participants who performed the activity before the COVID-19 crisis

Table 3 Percentages of participants who (did not) change(d) their activities during COVID-19

	Not different	In another environment	In another way	Comparable activity
Self-care (<i>n</i> = 1750)	61%	15%	22%	16%
Free time activities indoors (<i>n</i> = 1651)	44%	29%	22%	29%
Social activities outdoors (<i>n</i> = 1015)	11%	40%	70%	36%
Household (<i>n</i> = 1603)	79%	7%	13%	7%
Free time activities outdoors (<i>n</i> = 1226)	16%	69%	56%	10%
Caring for my health through sports (<i>n</i> = 1383)	32%	48%	34%	35%
Caring for my health through cooking (<i>n</i> = 1317)	68%	20%	15%	7%
Sexuality (<i>n</i> = 1085)	83%	4%	10%	5%
Attending trainings (<i>n</i> = 902)	6%	66%	84%	4%
Doing chores in and around the house (<i>n</i> = 824)	61%	17%	27%	8%
Going to work (<i>n</i> = 741)	23%	65%	31%	2%
Caring for family (<i>n</i> = 513)	56%	15%	23%	23%
Caring for others outside the family (<i>n</i> = 382)	25%	32%	55%	4%
Volunteering work (<i>n</i> = 205)	27%	39%	48%	12%
Caring for my health through mental activities (<i>n</i> = 358)	46%	23%	26%	29%
Student job (<i>n</i> = 106)	82%	6%	8%	4%
Doing chores for other people (<i>n</i> = 102)	37%	24%	40%	18%
Religious activities (<i>n</i> = 81)	37%	56%	26%	7%

with other still comparable activities evoking the same purpose or meaning.

Mental health, resilience and meaning in activities

Internal consistency of the measurement instruments was calculated for GHQ (Cronbach's Alpha = .888), EMAS (Cronbach's Alpha = .907), and CD-RISC (Cronbach's alpha = .883), and showed a good to excellent internal consistency for every instrument.

The mean GHQ score for the overall sample was 14.85. Based on the threshold score of 12 for adults, the mean score lies above the threshold score which reflects higher levels of psychological morbidity or distress.

Participants scored on average 24.85 on the CD-RISC, which indicates a lower resilience than the cut-off score of 29 for adults.

Based on the EMAS categories, 655 participants experienced low meaning in activities, 1013 participants experienced a moderate sense of meaning in their activities, and 83 experienced high meaning in their activities.

Bivariate analysis

The independent variables that were statistically significantly associated with mental health (GHQ) in the Mann–Whitney U test were gender, having children, living area, and living space. The results are displayed in Table 4. Woman scored significantly higher in the GHQ

than men ($p < .001$), which indicates lower mental health. Participants who had children scored significantly lower in the GHQ than adults without children, which indicates better mental health ($p < .001$). People living in an urban living area had lower mental health than participants who lived in a rural area ($p = .004$). Participants whose living space included a garden or balcony had a lower score in the GHQ which reflects better mental health ($p < .001$).

The significant independent variables associated with mental health and retrieved from the Kruskal-Wallis test were marital status, employment status, living condition, health condition. The results are displayed in Table 5.

Married respondents scored significantly lower in the GHQ than being divorced ($p = .033$), being alone ($p < .001$), and living together ($p < .001$), which indicates better mental health.

Being alone scored significantly lower in the GHQ than being a widow ($p = .019$) or living together ($p < .001$), meaning better mental health.

Students scored significantly higher in the GHQ than employed ($p < .001$) and unemployed adults ($p < .001$), indicating worse mental health.

Living alone scored significantly higher in the GHQ than living together with ($p = .001$) and without children ($p = .002$), meaning lower mental health.

Participants who lived with parent(s) or family scored higher in the GHQ than those living alone ($p = .025$),

Table 4 Overview bivariate analysis results (1): Mann-Whitney U test: differences between (dichotomous) groups for the General Health Questionnaire ($N = 1781$)

	GHQ Mean (SD)	Mann-Whitney U	Z	P
Gender		230,410	-6.909	<.001
Woman	15.44 (6.80)			
Men	13.04 (6.55)			
Having children		258,587	-9.364	<.001
Yes	12.89 (6.58)			
No	15.84 (6.72)			
Living area		356,404	-2.909	<.05
Rural	14.44 (6.71)			
Urban	15.41 (6.92)			
Informal caregiver		123,306	-1.704	.088
Yes	15.65 (6.90)			
No	14.77 (6.80)			
Receiving care		81,136	-1.779	.075
Yes	16.14 (7.40)			
No	14.77 (6.77)			
Living space		91,852.5	-4.06	<.001
Balcony/garden	14.62 (6.67)			
No balcony/garden	17.50 (7.9)			

Higher scores in GHQ means lower mental health

Table 5 Overview bivariate analysis results (2): Kruskal–Wallis test: differences between (categorical) groups for the General Health Questionnaire followed by Mann–Whitney U (N = 1781)

	GHQ Mean (Range; SD)	GHQ Median (inter quartile)	P-value Kruskal– Wallis	P-value Mann-Whitney U ^a
Marital status			<.001	
1.Married	12.54 (0–36; 6.18)	11 (9)		.033 between 1 and 2
2.Divorced	14.74 (3–32; 7.08)	15 (11)		<.001 between 1 and 3
3.Alone	16.56 (1–36; 6.79)	16 (10)		<.001 between 1 and 5
4.Widow	12.91 (1–23; 5.61)	13 (7)		<.001 between 1 and 6
5.Living together	14.17 (0–36; 6.73)	13 (10)		.019 between 3 and 4
6.Other	16.07 (2–35; 6.81)	16 (10)		<.001 between 3 and 5 .001 between 5 and 6
Educational level			.156	
Primary education	12.3 (4–20; 5.74)	10.50 (11)		
Secondary education	15.44 (1–35; 7.17)	14.50 (11)		
Higher education	14.69 (0–36; 6.71)	14 (10)		
Employment status			<.001	
1.Student	16.67 (1–36; 6.80)	16 (9)		<.001 between 1 and 2
2.Employed	13.16 (0–34; 6.25)	12 (9)		<.001 between 1 and 3
3.Not employed	13.78 (1–36; 6.90)	12 (9)		
Living condition			<.001	
1.Alone	15.19 (2–35; 7.30)	14 (11)		.002 between 1 and 3
2.Alone with children	14.29 (1–29; 6.97)	15 (10)		.001 between 1 and 4
3.Living together without children	13.09 (0–36; 6.23)	12 (9)		.025 between 1 and 5
4.Living together with children	12.83 (0–36; 6.47)	11.5 (9)		.001 between 1 and 7
5.Living in with parent(s),family	16.36 (1–36; 6.50)	16 (10)		.004 between 2 and 7
6.Room alone	19.27 (5–36; 8.37)	21 (12)		<.001 between 3 and 5
7.Room together	19.34 (3–35; 8.01)	22 (13)		.003 between 3 and 6
8.Other	14.88 (3–34; 7.96)	13 (11)		<.001 between 3 and 7 <.001 between 4 and 5 .002 between 4 and 6 <.001 between 4 and 7 .005 between 5 and 7 .025 between 7 and 8
Region			.545	
Flanders	14.88 (0–36; 6.80)	14 (11)		
Wallonia	14.81 (3–34; 7.53)	14 (11)		
Brussels	13.68 (2–32; 6.95)	12 (10)		
Working situation			.504	
Working from home	13.36 (0–33; 6.44)	13 (10)		
Work as usual	12.92 (4–30; 5.46)	11 (8)		
Technically unemployed	14.74 (4–34; 7.54)	13 (10)		
Other	14.28 (0–36; 7.58)	13 (8)		
Health condition			<.001	
1.Healthy	14.63 (0–36; 6.66)	14 (10)		.011 between 1 and 2
2.Acute ill	17.02 (2–31; 6.99)	16 (11)		.001 between 1 and 4
3.Chronically ill	15.06 (3–36; 7.09)	14 (10)		.042 between 2 and 3
4.Mentally ill	20.23 (2–36; 9.17)	20.50 (11)		.003 between 3 and 4

To increase the interpretability, means as well as medians were displayed in this table. Higher scores in GHQ indicate lower mental health. ^aThe numbers in the last column correspond with the groups described in column 1

living together (with children ($p < .001$) or without children ($p < .001$)), meaning lower mental health.

Participants who lived in a room together with other people (e.g., student accommodation) scored higher in the GHQ than participants who lived alone ($p = .001$), alone with children ($p = .004$), or those living together (with children ($p < .001$) or without children ($p < .001$)) or living in with parent(s) or family ($p = .005$), meaning lower mental health.

Participants who lived in a room alone scored higher in the GHQ than participants who lived together, with children ($p = .002$), meaning lower mental health.

Healthy participants scored lower in the GHQ than acutely ill participants ($p = .011$) or mentally ill participants ($p < .001$), which indicates better mental health. Chronically ill persons scored lower in the GHQ than mentally ill participants ($p = .003$) and acutely ill participants ($p = .042$), meaning better mental health.

As shown in Table 6, Spearman’s Rho test showed a significant moderate relationship between EMAS-GHQ ($R_s = -.547$, $p < .001$) and CD-RISC-GHQ ($R_s = -.524$, $p < .001$). Age was also significantly related to mental health ($R_s = -.254$, $p < .001$).

VIF factors showed no problems in terms of multicollinearity, except for ‘living condition’ and ‘marital status’, which reflect both whether or not respondents live alone or share their life with someone. The decision based on a VIF factor of 1 was to exclude living condition. A closer look at the variables ‘age’, ‘employment status’ and ‘having children’ showed that they intrinsically indicate the same thing, namely the stage of life. The correlations between age and employment status ($r = .792$), age and having children ($r = .753$) were strong. Accordingly, the decision was made to exclude ‘age’ in the following analysis.

Multivariate analysis

In the next step, mental health was regressed using all at once predictors that were statistically significantly related to mental health in the bivariate analysis.

Results from the hierarchical regression analysis are provided in Table 7. The eight control variables (gender, having children, living area, living space, employment status, marital status, health condition, and resilience (CD-RISC)) were entered simultaneously into Model 1

Table 6 Overview bivariate analysis (3): Spearman correlation test: associations between mental health and continuous independent variables in study sample ($N = 1781$)

	Spearman’s Rho	P
EMAS	-.547	<.001
CD-RISC	-.524	<.001
Age	-.254	<.001

Table 7 Hierarchical regression analysis of demographic characteristics, personal factors and meaning in activities associated with mental health

	Mental health					
	Model 1			Model 2		
	B	SE B	β	B	SE B	β
Control variables						
Gender	-.793	.317	-.050*	-.596	.294	-.038*
Having children	-.968	.353	-.067*	-.798	.328	-.055*
Living area	.391	.279	.028	.254	.259	.018
Living space	-1.164	.512	-.046*	-1.002	.476	-.040*
Employment status	-.297	.314	-.021	-.083	.292	-.006
Marital status	-1.536	.331	-.112**	-1.037	.309	-.076*
Health condition	-.975	.344	-.059*	-.884	.319	-.054*
Resilience (CD-RISC)	-.530	.021	-.501**	-.351	.022	-.332**
Main effect						
EMAS				-.363*	.022	-.358**
R ²			.335**			.427**
Adjusted R ²			.332**			.424**
R ² change			.335**			.092**

**significant result ($p < .001$), *significant result ($p < .05$)

and together accounted significantly for 33.2% of the variance in mental health ($p < .001$). In Model 2, the variable meaning in activity (EMAS) was added to the regression equation, which explained 9.2% incremental variance, augmenting the total explained variance in mental health to 42.4% ($p < .001$). Six of the eight control variables were significantly associated with mental health, including gender ($\beta = -.038$; $p = .043$), having children ($\beta = -.055$; $p = .015$), living space ($\beta = -.040$; $p = .035$), marital status ($\beta = -.076$; $p = .001$), health condition ($\beta = -.054$; $p = .006$), and resilience ($\beta = -.332$; $p < .001$).

Discussion

To gain insight into the mental health of Belgian adults during the COVID-19 lockdown, this study investigated some potential predictors of mental health and focused on the role of meaning in activities in particular. Based on our results, we could confirm our hypothesis that meaningful activities do contribute to general mental health in adults during COVID-19 lockdown.

The COVID-19 pandemic caused significant changes to peoples’ daily lives as their movements were restricted in an effort to slow down the spread of the virus. Faced with new realities of working from home, online meetings, temporary unemployment, home-schooling (of children), and lack of social contact with friends and family, the mental health of people was affected [64].

Based on the discussion of Allsop and colleagues [65], the number of people suffering from mental health problems during a major event is often greater than the number of people suffering from physical problems. The results of our study showed low mental health among Belgian adults, which is not unexpected as current COVID-19 research showed similar results elsewhere. Using the same instrument, GHQ, researchers from the United Kingdom Household Longitudinal Study (UKHLS) [66] did a comparison between mental health pre-COVID-19 and during COVID-19, they found that adults had worse mental health during COVID-19 than pre-COVID-19. A follow-up study found that, in the first COVID-19 wave 29.2% of their respondents scored above the threshold on the GHQ, which indicates cases of psychiatric disorder [67]. Furthermore, from April 2020 until June 2020, all sociodemographic groups showed significant increases in mental health problems in the UK [68].

The loss of mental health can, according to our study results, be partly explained by the loss of meaning in activities. Hierarchical regression showed that meaning in activities (EMAS) accounted incrementally for 9.2% of the variance in mental health (GHQ), beyond the effects of demographic and personal variables. The subjective experience of meaning associated with engagement in activity may be a key mechanism through which daily activities influence personal well-being and, according to the study results, mental health [69–71]. As stated, meaning in activities is a key outcome of human health and well-being and our study demonstrated that this also holds true during a pandemic, when anxiety and stress prevail [42, 44].

As the forced adaptation to the lockdown measures likely caused an unintended disruption or even (temporary) loss of daily activities (e.g., work, hobbies) for most people (e.g., children, adults, and elderly), one might expect that day-to-day living, behavior, and well-being might be blurred [4, 66]. People were forced to adapt their daily activities, and activities that could not easily be adapted — such as volunteering work, student jobs, and most affected of all, social activities outdoors — had to be discontinued [72]. At the start of the lockdown, people experienced the measures as a temporary disruption of the situation and adapted by trying to find new ways to experience meaning in the performed activities by changing the form of the activity, searching for other activities, or changing their time investment in these activities [73]. As the lockdown persisted, people struggled to find meaning and started to attribute the negative effects of the measures to features beyond their control (e.g., people started blaming the government that the measures were too hard). We thus assume, based on an occupational therapy model, that the temporary

disruption turned into experiences of deprivation in which the people were restricted from participation in necessary meaningful activities due to circumstances outside their control [74].

It can be presumed that the longer the COVID-19 pandemic lasted, the more difficult it was to remain satisfied with curtailed activities, and the more people lost meaning in these activities. Due to the imposed measures, the form in which people were forced to perform their activities was reduced to basic functions (e.g. the function of shopping is to ensure oneself of the necessary ingredients to stay alive) [73]. People became task-oriented, yet were less likely to engage in creative thinking which is primarily driven primarily by enjoyment and a sense of meaning in activities [75, 76]. Consequently, the form of the activities did not leave enough room for aspects of meaning, such as shopping together for fun. This could thus be an explanation of why most of the participants experienced moderate meaning in activities. Comparing this result with a normative adult group that scored high in meaning in activities under normal circumstances ($M = 45,3$), we can state that the COVID-19 lockdown caused a serious loss in meaning in activities for Belgian adults [51]. Resilience was the second strongest contributor to mental health after meaning in activity. These results are in line with other recent studies. In the face of COVID-19, people need to cope with these ongoing stressors and minimize psychological distress [77]. Being resilient can protect against these events and make it possible to thrive from adversity [78–80]. In a COVID-19 study across healthcare and non-healthcare professionals, higher resilience scores were associated with lower COVID-19 related worries, as well as a reduced rate of anxiety and depression [14].

The demographic factors gender, having children, marital status, living space, and current health condition contributed statistically significantly to lower mental health in our study sample. Women had lower mental health than men in this study, which is in line with other COVID-19 studies of mental health in women [13, 19, 20, 22]. Females' sense of identity in activities is more affected by the social connections formed, rather than by other aspects in the activity setting [81]. Women seem to attach more meaning to social activities, which could hardly or no longer be carried out during COVID-19 lockdown, while men attach more meaning to physical activities that could still be performed during lockdown. The care and household tasks, in which women are usually more active, interfered much more with other activities than usual during lockdown. In Belgium, parenting adults could request corona leave to manage the care of (home-schooled) children. Seventy-five percent of the parents who claimed the leave appeared to be women [82]. In general, women were found to be more

susceptible to mental health related symptoms than men because they show greater emotional response [27]. It can thus be concluded that women were found to be slightly more vulnerable in terms of mental health than men.

It seems that being married during the COVID-19 lockdown helped respondents to have better mental health. There is a considerable amount of evidence showing that married people have better mental health than never-married and divorced people [83, 84], which can be explained by the importance of the satisfaction and support associated with such a dedicated relationship [85]. Our study results suggest that living alone may be related to lower mental health during lockdown compared to adults who are widows or living together. Previous research has also confirmed that living with a partner is a protective factor for general psychiatric disorders during the COVID-19 crisis [67].

Next, our study results demonstrated that chronically ill adults need to have specific attention. They are less affected in terms of mental health during the COVID-19 lockdown compared to mentally and acutely ill adults. Moreover, it is remarkable that chronically ill persons did not statistically significantly differ from healthy people. They may have been better able to adapt to the changing situation in COVID-19 lockdown because they already experienced a loss of activity and prolonged isolation due to their illness, thus preparing them to be better able to cope with this crisis [86, 87].

To our knowledge, living space has not yet been described in the COVID-19 literature as a contributor to mental health. During the COVID-19 lockdown, the strict measures prohibited outdoor activities: people only could leave the house to provide for the necessities of life or to work if telecommuting was not possible. People who lived with access to a garden or balcony, could go outside and do physical or psychological activities there. It is already proven that (physical) activities in an outdoor space can protect against mental health problems, and restricted access is likely to have negative implications for mental health [88–96]. People without the opportunity to go outside their house (e.g. no garden or balcony) might have experienced deprivation, which could cause the lower mental health we found in this study. Similar results were found in an epidemiological study where the type of housing children inhabited altered mental health correlates [97]. High-rise multiple dwelling units are inimical to the mental health of mothers with young children because of the social isolation and restricted play opportunities for children [97]. A study in low-income housing areas in London showed that having less access to private gardens was associated with a higher prevalence of depression [98].

Although we found a statistically significant bivariate association between living area (rural versus urban) and

mental health in our study sample of adults, it was not a significant contributor for mental health in the multivariate analysis. This suggests that its explanatory power is limited compared to the other included predictors. Living in a rural area was associated with better mental health during the COVID-19 lockdown than living in an urban area, perhaps because it provides opportunities to take long walks outdoors and, be in nature, which positively promotes mental health [88–96]. However, this is contradicted in the study of Summer-Gabr [99] in the United States, where living in urban areas appeared to show better mental health than people living in rural areas due to better access to health care and mental health services. We speculate that the meaning and potential impact of a variable such as living area on mental health might be weakened in our study as Belgium is a very small country in which the difference between rural and urban areas is less manifest. This implies that other factors, such as resilience and one's engagement in meaningful activities, might have a greater influence on mental health.

Finally, participants without children had lower mental health than adults with children. This is contrary to the common findings in the current literature. A national COVID-19 study in the US explained the low mental health in parents by the fact that parents reported worsening behavioral health for their children [28] and unstable financial circumstances, school closure, suspended educational services for children may underlie low mental health in parents [100]. Our contrary results could be due to the fact that most of the participants who did not have children in our study, were students who do not belong to the working adults group.

An unexpected result is that work status was not significantly associated with mental health in the multivariate analysis, despite a bivariate association. COVID-19 studies have already shown that unemployed adults and students have a greater chance of being exposed to mental health problems [19, 67]. Similarly, in our study, students reported lower mental health compared to employed and non-employed adults, and the latter two groups did not differ substantially in terms of mental health. These results might reflect that students were a vulnerable subgroup during COVID-19 lockdown. Alternatively, employment, as measured in our study, might be too generic a variable, which neglects the type of job one performs or its characteristics. It might be that mental health is more influenced by the extent of remote working and its interference with daily functioning at home.

Remarkably, educational level was not significantly related to mental health in our study. This contradicts previous studies that have shown people with higher degrees (above bachelor's level) experienced an increase

in mental health problems at the time of the pandemic [26, 68]. Our result might be due to range restriction, as the majority (76.6%) of our participants held a higher educational degree (University of Applied Sciences or University).

Nevertheless, our study demonstrated that maintaining or reconstructing meaningful activities during the COVID-19 pandemic seemed to be an important pathway to build a meaningful life in the context of profound disruption [101]. Increasing awareness of the importance of meaningful activities in daily life might lead to more widespread recognition of the potentially detrimental effects of disruption and deprivation of such activities when these occur [102].

The impact that isolation due to COVID-19 lockdown has on people's ability to achieve a sense of occupational balance, defined as a balance of engagement in occupations that leads to well-being [103], is alarming. Occupational therapists thus have a critical role to play in helping people respond to this type of crisis [104], and leaders in the profession have articulated its relevance in supporting mental health and wellbeing in populations worldwide [101, 105, 106]. Occupational therapists have already learned a lot from their clients about how everyday life might be rebuilt within constraining parameters that are out of the client's control. Our unique occupational focus can be central in identifying new and creative solutions in response to the unprecedented and challenging COVID-19 crisis, as we have the right knowledge and the creativity to respond to the massive impact of the COVID-19 pandemic on our clients and the general population [104]. Providing meaningful activities during social lockdown is an important point of attention that, in addition to health and economic aspects, should be taken into account when deciding on measures concerning COVID-19.

To our knowledge, this is one of the first national sample studies to consider a comprehensive set of factors that might contribute to adults' mental health, and in particular, identified meaningful activities as a plausible key predictor of mental health during times of global crisis.

Conclusion

The findings suggest that sociodemographic factors, resilience, and meaning in activities were associated with reduced mental health. Each of the seven identified factors has to be taken into account to emerge from lockdown in a sustainable way and from a social perspective, to maintain mental health. This study stressed the importance of activities during COVID-19 and raises a new idea that could be interesting for health policymakers during and beyond COVID-19: besides economical and health aspects, meaning in activities must also be taken

into account throughout lockdown decision-making processes and measures.

Methodological considerations / limitations

The presented results need to be interpreted with caution owing to some study limitations. First, because this study was initiated during the COVID-19 pandemic, we could not rely on data from the Belgian population regarding resilience, mental health, and meaningful activities from the period before the pandemic. As a consequence, comparisons were not possible and we were unable to capture changes or trajectories in mental health or any of the identified predictors.

Second, the GHQ-12 failed to be a clinical assessment in this study. Results should be interpreted with caution and do not mean that people with low mental health have a mental illness [66].

Third, as our findings are based on a cross-sectional research design, no causal statements can be inferred. Although the present study has shown that there is a strong positive relationship between meaningful activities and mental health in Belgian adults, further longitudinal studies are needed to investigate potential causal effects.

Fourth, as the participants in our sample are not completely representative of the whole Belgium population, future researchers might investigate the generalizability of the study findings to other target groups and countries as well.

Fifth, exclusively self-reported measures were used in this study. These measures can cause common method variance, which can influence results [107]. The authors of this study did, however, take precautions to reduce this possible effect by indicating that there were no right or wrong answers, by guaranteeing anonymity, and by using existing valid scales with sufficient internal consistency. Future research might incorporate ratings from multiple sources (e.g., peer ratings) or assess more objective indicators and measures, in addition to subjective measures. Finally, another drawback of a self-reported online survey is that participants who have questions cannot address them directly to the researcher. To give participants the opportunity to raise questions we did include, however, an open field question at the end of the survey (last question), for this purpose, and the contact details of the first author of this study were given at the start of the survey and participants were encouraged to e-mail with questions and comments regarding the survey as well.

Abbreviations

COVID-19: Coronavirus Disease; WHO: World Health Organization; SARS: Severe Acute Respiratory Syndrome; H: Hypothesis; STROBE: Strengthening the Reporting of Observational Studies in Epidemiology; ICF: International Classification of Functioning, Disability and

Health; GHQ: General Health Questionnaire; CD-RISC: Connor-Davidson Resilience Scale; EMAS: Engagement in Meaningful Activities Survey; VIF: Variance Inflation Factor; UKHLS: United Kingdom Household Longitudinal Study

Acknowledgements

Not applicable.

Authors' contributions

EC made the largest contributions throughout the research. She initialized the research and made the web survey, did the data analysis, and wrote the article. Everything happened under the supervision of the promoters and in consultation with the other authors. She agreed both to be personally accountable for the author's own contributions. DVP and VDVD were the main promoters of the first author (EC), made substantial contributions throughout the research, helped in the interpretation of data, helped to create the web survey, improved the writing, approved the submitted version and agreed both to be personally accountable for the author's own contributions. DLM, VP, CP, DPR, and OK made substantial contributions throughout the research, helped to analyze the data, helped to create the web survey, improved the writing, approved the submitted version and agreed both to be personally accountable for the author's own contributions. SA helped to translate the web survey, improved the writing, helped to create the web survey, approved the submitted version, and agreed both to be personally accountable for the author's own contributions. RBM, MBJA, FSAJ, and VML helped to translate and create the web survey, improved the writing, approved the submitted version, and agreed both to be personally accountable for the author's own contributions.

Funding

There was no funding for this research project.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved (April 10, 2020) by the Ethical Committee of Ghent University (BC-07585). Participants gave informed consent by clicking on the survey's next page button confirming they read the information. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹Faculty of Medicine and Health Sciences, Department of Rehabilitation Sciences, Occupational Therapy, Physiotherapy and Speech-language Pathology/Audiology, Ghent University, Corneel Heymanslaan 10, B3, entrance 46, 9000 Ghent, Belgium. ²Department of Occupational Therapy, Artevelde University College, Ghent, Belgium. ³Mental Health Research group, Frailty in Ageing Research Group, Vrije Universiteit Brussel, Brussels, Belgium. ⁴Faculty of Psychology and Educational Sciences, Department of Work, Organization and Society, Ghent University, Ghent, Belgium. ⁵Department of Physiotherapy (Occupational Therapy), University of Malaga, Málaga, Spain. ⁶Psychological Sciences Research Institute, Université catholique de Louvain, Louvain-la-Neuve, Belgium. ⁷Department of Experimental Psychology, Ghent University, Ghent, Belgium. ⁸Research group on Methodology, Methods, Models and Outcomes of Health and Social Sciences (M3O), Faculty of Health Science and Welfare, University of Vic-Central University of Catalonia (UVIC-UCC), 08500 Vic, Spain. ⁹Department of Occupational Therapy, School of Health Sciences, Catholic University of Murcia, Murcia, Spain. ¹⁰Research Group GrEUIT, Escola Universitària d'Infermeria i Teràpia Ocupacional de Terrassa (EUIT), Universitat Autònoma de Barcelona, Terrassa, Spain.

Received: 17 December 2020 Accepted: 22 March 2021

Published online: 30 March 2021

References

- Nishiura H, Jung SM, Linton NM, Kinoshita R, Yang Y, Hayashi K, et al. The extent of transmission of novel coronavirus in Wuhan, China, 2020. *J Clin Med*. 2020;9(2):330. <https://doi.org/10.3390/jcm9020330>.
- Chan KW, Wong VT, Tang SCW. COVID-19: an update on the epidemiological, clinical, preventive and therapeutic evidence and guidelines of integrative Chinese–Western medicine for the management of 2019 novel coronavirus disease. *Am J Chinese Med*. 2020;48(03):737–62. <https://doi.org/10.1142/S0192415X20500378>.
- Mahase E. China coronavirus: WHO declares international emergency as death toll exceeds 200. *BMJ*. 2020;368:m408.
- Haug N, Geyrhofer L, Londei A, Dervic E, Desvars-Larrive A, Loreto V, et al. Ranking the effectiveness of worldwide COVID-19 government interventions. *Nat Hum Behav*. 2020;4(12):1303–12. <https://doi.org/10.1038/s41562-020-01009-0>.
- World Health Organization. Consensus document on the epidemiology of severe acute respiratory syndrome (SARS) 2003. Geneva: World Health Organization; 2005.
- Silva CA, Queiroz LB, Fonseca CdB, et al. Spotlight for healthy adolescents and adolescents with preexisting chronic diseases during the COVID-19 pandemic. *Clinics*. 2020;75:e1931.
- Sciensano. Brussels. [Coronavirus in numbers and maps 2020]. Available from: <https://www.coronaviruscovid19.be/coronavirus-cijfers>. Dutch. Accessed 14 Oct 2020.
- Preti E, Di Mattei V, Perego G, et al. The psychological impact of epidemic and pandemic outbreaks on healthcare workers: rapid review of the evidence. *Curr Psychiatry Rep*. 2020;22(8):1–22.
- Khademian F, Delavari S, Koohjani Z, et al. An investigation of depression, anxiety, and stress and its relating factors during COVID-19 pandemic in Iran. *BMC Public Health*. 2021;21:275. <https://doi.org/10.1186/s12889-021-10329-3>.
- Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *Lancet Psychiatry*. 2020;7(6):547–60. [https://doi.org/10.1016/S2215-0366\(20\)30168-1](https://doi.org/10.1016/S2215-0366(20)30168-1).
- Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*. 2020;395(10227):912–20. [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8).
- Khan KS, Mamun MA, Griffiths MD, Ullah I. The mental health impact of the COVID-19 pandemic across different cohorts. *Int J Ment Health Addic*. 2020. <https://doi.org/10.1007/s11469-020-00367-0>.
- Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic— a review. *Asian J Psychiatry*. 2020;51:102–19.
- Barzilay R, Moore TM, Greenberg DM, et al. Resilience, COVID-19-related stress, anxiety and depression during the pandemic in a large population enriched for healthcare providers. *Transl Psychiatry*. 2020;10(1):1–8.
- Zaka A, Shamloo SE, Fiorente P, et al. COVID-19 pandemic as a watershed moment: a call for systematic psychological health care for frontline medical staff. London: SAGE Publications Sage UK; 2020.
- Zandifar A, Badrfam R. Iranian mental health during the COVID-19 epidemic. *Asian J Psychiatry*. 2020;51:101990. <https://doi.org/10.1016/j.ajp.2020.101990>.
- Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: mental health consequences and target populations. *Psychiatry Clin Neurosci*. 2020; 74(4):281–2. <https://doi.org/10.1111/pcn.12988>.
- Williams R, Jenkins DA, Ashcroft DM, Brown B, Campbell S, Carr MJ, et al. Diagnosis of physical and mental health conditions in primary care during the COVID-19 pandemic: a retrospective cohort study. *Lancet Public Health*. 2020;5(10):e543–50. [https://doi.org/10.1016/S2468-2667\(20\)30201-2](https://doi.org/10.1016/S2468-2667(20)30201-2).
- Solomou I, Constantinidou F. Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measures: age and sex matter. *Int J Environ Res Public Health*. 2020;17(14):4924. <https://doi.org/10.3390/ijerph17144924>.
- Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in

- China. *Int J Environ Res Public Health*. 2020;17(5):1729. <https://doi.org/10.3390/ijerph17051729>.
21. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res*. 2020;288:112954. <https://doi.org/10.1016/j.psychres.2020.112954>.
 22. Lee CM, Cadigan JM, Rhew IC. Increases in loneliness among young adults during the COVID-19 pandemic and association with increases in mental health problems. *J Adolesc Health*. 2020;67(5):714–7. <https://doi.org/10.1016/j.jadohealth.2020.08.009>.
 23. Guo Y, Cheng C, Zeng Y, Li Y, Zhu M, Yang W, et al. Mental health disorders and associated risk factors in quarantined adults during the COVID-19 outbreak in China: cross-sectional study. *J Med Internet Res*. 2020;22(8):e20328. <https://doi.org/10.2196/20328>.
 24. National Center for Health Statistics. Mental health: household pulse survey. US Centers for Disease Control and Prevention. 2020 Available from: <https://www.cdc.gov/nchs/covid19/pulse/mental-health.htm>. Retrieved 25 Jan 2021.
 25. McGinty EE, Presskreischer R, Han H, et al. Psychological distress and loneliness reported by US adults in 2018 and April 2020. *JAMA*. 2020;324(1):93–4. <https://doi.org/10.1001/jama.2020.9740>.
 26. Islam MS, Ferdous MZ, Potenza MN. Panic and generalized anxiety during the COVID-19 pandemic among Bangladeshi people: an online pilot survey early in the outbreak. *J Affect Disord*. 2020;276:30–7. <https://doi.org/10.1016/j.jad.2020.06.049>.
 27. Wu M, Xu W, Yao Y, et al. Mental health status of students' parents during COVID-19 pandemic and its influence factors. *Gen Psychiatry*. 2020;33(4):e100250.
 28. Patrick SW, Henkhaus LE, Zickafoose JS, et al. Well-being of parents and children during the COVID-19 pandemic: a national survey. *Pediatrics*. 2020;146(4):e2020016824.
 29. Cao W, Fang Z, Hou G, et al. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res*. 2020;112934.
 30. Chen P, Mao L, Nassiss G, et al. Coronavirus disease (COVID-19): the need to maintain regular physical activity while taking precautions. *J Sport Health Sci*. 2020;9(2):103–4. <https://doi.org/10.1016/j.jshs.2020.02.001>.
 31. Kondo N, Kazama M, Suzuki K, Yamagata Z. Impact of mental health on daily living activities of Japanese elderly. *Prev Med*. 2008;46(5):457–62. <https://doi.org/10.1016/j.ypmed.2007.12.007>.
 32. Bjorkedal STB, Bejerholm U, Eplöv LF, et al. Meaningful activities and recovery (MA&R): the effect of a novel rehabilitation intervention among persons with psychiatric disabilities on activity engagement—study protocol for a randomized controlled trial. *Trials*. 2020;21(1):1–11.
 33. Kingston T, Scully PJ, Browne DJ, et al. Functional outcome and service engagement in major depressive disorder with psychotic features: comparisons with schizophrenia, schizoaffective disorder and bipolar disorder in a 6-year follow-up of the Cavan-Monaghan first episode psychosis study (CAMFEPS). *CNS Neurosci Ther*. 2018;24(7):633–40.
 34. Goldberg B, Brintnell ES, Goldberg J. The relationship between engagement in meaningful activities and quality of life in persons disabled by mental illness. *Occup Ther Ment Health*. 2002;18(2):17–44. https://doi.org/10.1300/J004v18n02_03.
 35. Petrusciene D, Surmaitiene D, Baltaduoniene D, et al. Effect of community-based occupational therapy on health-related quality of life and engagement in meaningful activities of women with breast Cancer. *Occup Ther Int*. 2018;2018:6798697.
 36. Bjorkedal ST, Torsting AM, Moller T. Rewarding yet demanding: client perspectives on enabling occupations during early stages of recovery from schizophrenia. *Scand J Occup Ther*. 2016;23(2):97–106. <https://doi.org/10.3109/11038128.2015.1082624>.
 37. Gould A, DeSouza S, Rebeiro-Gruhl LK. And then I lost that life: a shared narrative of four young men with schizophrenia. *Br J Occup Ther*. 2005;68(10):467–73. <https://doi.org/10.1177/030802260506801005>.
 38. Bejerholm U. Relationships between occupational engagement and status of and satisfaction with sociodemographic factors in a group of people with schizophrenia. *Scand J Occup Ther*. 2010;17(3):244–54. <https://doi.org/10.3109/11038120903254323>.
 39. Bejerholm U, Areberg C. Factors related to the return to work potential in persons with severe mental illness. *Scand J Occup Ther*. 2014;21(4):277–86. <https://doi.org/10.3109/11038128.2014.889745>.
 40. Lexén A, Bejerholm U. Occupational engagement and cognitive functioning among persons with schizophrenia: an explorative study. *Scand J Occup Ther*. 2018;25(3):172–9. <https://doi.org/10.1080/11038128.2017.1290135>.
 41. Bejerholm U, Eklund M. Construct validity of a newly developed instrument: profile of occupational engagement in people with schizophrenia, POES. *Nord J Psychiatry*. 2006;60(3):200–6. <https://doi.org/10.1080/08039480600636239>.
 42. Ryff CD, Singer B. The role of purpose in life and personal growth in positive human health. Mahwah: Lawrence Erlbaum Associates Publishers; 1998.
 43. Baumeister RF, Scholer FEE. Meanings of life. New York: Guilford Press; 1991.
 44. Roepke AM, Jayawickreme E, Riffle OM. Meaning and health: a systematic review. *Appl Res Qual Life*. 2014;9(4):1055–79. <https://doi.org/10.1007/s11482-013-9288-9>.
 45. Reker GT, Wong PT. Aging as an individual process: toward a theory of personal meaning. In: Birren JE, Bengtson VL, editors. Emergent theories of aging. Cham: Springer Publishing Company; 1988. p. 214–46.
 46. Clark F, Azen SP, Zemke R, et al. Occupational therapy for independent-living older adults: a randomized controlled trial. *JAMA*. 1997;278(16):1321–6. <https://doi.org/10.1001/jama.1997.03550160041036>.
 47. Smith N, Towers A-M, Palmer S, et al. Being occupied: supporting 'meaningful activity' in care homes for older people in England. *Ageing Soc*. 2018;38(11):2218–40. <https://doi.org/10.1017/S0144686X17000678>.
 48. Von Elm E, Altman DG, Egger M, et al. The strengthening of reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Ann Intern Med*. 2007;147(8):573–7. <https://doi.org/10.7326/0003-4819-147-8-200710160-00010>.
 49. WHO. International classification of functioning, disability and health: ICF: Geneva: World Health Organization; 2001.
 50. Eakman AM. Convergent validity of the Engagement in Meaningful Activities Survey in a college sample. *OTJR (Thorofare, N J)*. 2011;31(1):23–32.
 51. De Cocker K, Ketels M, Bennie JA, et al. Is device-based total and domain-specific sedentary behaviour associated with psychological distress in Flemish workers? *Eur J Pub Health*. 2020;31(1):151–6. <https://doi.org/10.1093/eurpub/ckaa144>.
 52. Hooyberg A, Roose H, Grellier J, Elliott LR, Lonneville B, White MP, et al. General health and residential proximity to the coast in Belgium: results from a cross-sectional health survey. *Environ Res*. 2020;184:109225. <https://doi.org/10.1016/j.envres.2020.109225>.
 53. Poppelmonde J. [Second wave mentally weighs even heavier than first wave] [Internet. De Standaard. Available from: https://www.standaard.be/cnt/dmf20201117_98085722. Dutch. Accessed 20 November 2020.
 54. Goldberg DP, Gater R, Sartorius N, et al. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psych Med*. 1997;27(1):191–7. <https://doi.org/10.1017/S0033291796004242>.
 55. Connor KM, Davidson JR. Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). *Depress Anxiety*. 2003;18(2):76–82. <https://doi.org/10.1002/da.10113>.
 56. Southwick SM, Bonanno GA, Masten AS, Panter-Brick C, Yehuda R. Resilience definitions, theory, and challenges: interdisciplinary perspectives. *Eur J Psychotraumatol*. 2014;5(1):25338. <https://doi.org/10.3402/ejpt.v5.25338>.
 57. Campbell-Sills L, Stein MB. Psychometric analysis and refinement of the Connor-Davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. *J Trauma Stress*. 2007;20(6):1019–28. <https://doi.org/10.1002/jts.20271>.
 58. Notario-Pacheco B, Solera-Martínez M, Serrano-Parra MD, Bartolomé-Gutiérrez R, García-Campayo J, Martínez-Vizcaino V. Reliability and validity of the Spanish version of the 10-item Connor-Davidson resilience scale (10-item CD-RISC) in young adults. *Health Qual Life Outcomes*. 2011;9(1):63. <https://doi.org/10.1186/1477-7525-9-63>.
 59. Wang L, Shi Z, Zhang Y, Zhang Z. Psychometric properties of the 10-item Connor-Davidson resilience scale in Chinese earthquake victims. *Psychiatry Clin Neurosci*. 2010;64(5):499–504. <https://doi.org/10.1111/j.1440-1819.2010.02130.x>.
 60. Antúnez JM, Navarro JF, Adan A. Circadian typology is related to resilience and optimism in healthy adults. *Chronobiol Int*. 2015;32(4):524–30. <https://doi.org/10.3109/07420528.2015.1008700>.
 61. Kuiper H, van Leeuwen CC, Stolwijk-Swüste JM, et al. Measuring resilience with the Connor-Davidson resilience scale (CD-RISC): which version to choose? *Spinal Cord*. 2019;57(5):360–6. <https://doi.org/10.1038/s41393-019-0240-1>.
 62. Eakman AM. Measurement characteristics of the engagement in meaningful activities survey in an age-diverse sample. *Am J Occup Ther*. 2012;66(2):e20–9. <https://doi.org/10.5014/ajot.2012.001867>.

63. Eakman AM, Carlson M, Clark F. Factor structure, reliability and convergent validity of the engagement in meaningful activities survey for older adults. *OTJR (Thorofare N J)*. 2010;30(3):111–21.
64. World Health Organization. Mental health & COVID-19; 2020. Available from: <https://www.who.int/teams/mental-health-and-substance-use/covid-19>. Accessed 22 Nov 2020.
65. Allsopp K, Brewin CR, Barrett A, et al. Responding to mental health needs after terror attacks. *BMJ*. 2019;366:l4828.
66. Pierce M, Hope H, Ford T, Hatch S, Hotopf M, John A, et al. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry*. 2020;7(10):883–92. [https://doi.org/10.1016/S2215-0366\(20\)30308-4](https://doi.org/10.1016/S2215-0366(20)30308-4).
67. Li LZ, Wang S. Prevalence and predictors of general psychiatric disorders and loneliness during COVID-19 in the United Kingdom. *Psychiatry Res*. 2020;291:113267. <https://doi.org/10.1016/j.psychres.2020.113267>.
68. Daly M, Sutin A, Robinson E. Longitudinal changes in mental health and the COVID-19 pandemic: evidence from the UK household longitudinal study. *Psychol Med*. 2020:1–37. <https://doi.org/10.1017/S0033291720004432>.
69. Townsend E, Polatajko HJ. Advancing an occupational therapy vision for health, well-being, and justice through occupation. Ottawa: CAOT Publications ACE; 2007.
70. Wilcock A, Van Der Arend H, Darling K, et al. An exploratory study of people's perceptions and experiences of wellbeing. *Br J Occup Ther*. 1998; 61(2):75–82. <https://doi.org/10.1177/030802269806100206>.
71. Yerxa EJ. An introduction to occupational science, a foundation for occupational therapy in the 21st century. *Occup Ther Health Care*. 1990;6(4): 1–17. https://doi.org/10.1080/J003v06n04_04.
72. Lachance EL. COVID-19 and its impact on volunteering: moving towards virtual volunteering. *Leis Sci*. 2020:1–7. <https://doi.org/10.1080/01490400.2020.1773990>.
73. Bond AJ, Widdop P, Cockayne D, Parnell D. Prosumption, networks and value during a global pandemic: lockdown leisure and COVID-19. *Leis Sci*. 2020:1–8. <https://doi.org/10.1080/01490400.2020.1773985>.
74. Whiteford G. Occupational deprivation: global challenge in the new millennium. *Br J Occup Ther*. 2000;63(5):200–4. <https://doi.org/10.1177/030802260006300503>.
75. Benedek M, Bruckdorfer R, Jauk E. Motives for creativity: exploring the what and why of everyday creativity. *J Create Behav*. 2020;54(3):610–25. <https://doi.org/10.1002/jocb.396>.
76. Karwowski M, Zielińska A, Jankowska D, et al. Creative lockdown? A Daily Diary Study of Creative Activity During Pandemics. *Front Psychol*. 2021;12: 600076.
77. Chen S, Bonanno GA. Psychological adjustment during the global outbreak of COVID-19: a resilience perspective. *Psychol Traum*. 2020;12(S1):S51–4. <https://doi.org/10.1037/tra0000685>.
78. Perlman D, Patterson C, Moxham L, Taylor EK, Brighton R, Sumskis S, et al. Understanding the influence of resilience for people with a lived experience of mental illness: a self-determination theory perspective. *J Community Psychol*. 2017;45(8):1026–32. <https://doi.org/10.1002/jcop.21908>.
79. Hu T, Zhang D, Wang J. A meta-analysis of the trait resilience and mental health. *Pers Individ Differ*. 2015;76:18–27. <https://doi.org/10.1016/j.paid.2014.11.039>.
80. Davydov DM, Stewart R, Ritchie K, Chaudieu I. Resilience and mental health. *Clin Psychol Review*. 2010;30(5):479–95. <https://doi.org/10.1016/j.cpr.2010.03.003>.
81. Sharp EH, Coatsworth JD, Darling N, Cumsille P, Ranieri S. Gender differences in the self-defining activities and identity experiences of adolescents and emerging adults. *J Adolesc*. 2007;30(2):251–69. <https://doi.org/10.1016/j.adolescence.2006.02.006>.
82. De Morgen. Brussels. [Corona pushes women back to the fireplace 2020]. Available from: <https://www.demorgen.be/nieuws/corona-duwt-vrouwen-weer-naar-de-haard~bd06ce59/>. Dutch. Accessed 26 Nov 2020.
83. Uecker JE. Marriage and mental health among young adults. *J Health Soc Behav*. 2012;53(1):67–83. <https://doi.org/10.1177/0022146511419206>.
84. Ahmad A, Rahman I, Agarwal M. Factors Influencing Mental Health During Covid-19 Outbreak: An Exploratory Survey Among Indian Population. *medRxiv*. 2020; doi:<https://doi.org/10.1101/2020.05.03.20081380>.
85. Holt-Lunstad J, Birmingham W, Jones BQ. Is there something unique about marriage? The relative impact of marital status, relationship quality, and network social support on ambulatory blood pressure and mental health. *Ann Behav Med*. 2008;35(2):239–44. <https://doi.org/10.1007/s12160-008-9018-y>.
86. Christiansen C, Townsend EA. Introduction to occupation: the art and science of living. Harlow: Pearson Education Limited; 2009.
87. Craig H, Edwards J. Adaptation in chronic illness: an eclectic model for nurses. *J Adv Nurs*. 1983;8(5):397–404. <https://doi.org/10.1111/j.1365-2648.1983.tb00463.x>.
88. Paluska SA, Schwenk TL. Physical activity and mental health. *Sports Med*. 2000;29(3):167–80. <https://doi.org/10.2165/00007256-200029030-00003>.
89. Demont-Heinrich C. The association between physical activity, mental health and quality of life: a population-based study. *Health*. 2009;800:886–7689.
90. Stephens T. Physical activity and mental health in the United States and Canada: evidence from four population surveys. *Prev Med*. 1988;17(1):35–47. [https://doi.org/10.1016/0091-7435\(88\)90070-9](https://doi.org/10.1016/0091-7435(88)90070-9).
91. Cox DT, Shanahan DF, Hudson HL, Plummer KE, Siriwardena GM, Fuller RA, et al. Doses of neighborhood nature: the benefits for mental health of living with nature. *BioScience*. 2017;67(2):147–55.
92. Parr H. Mental health, nature work, and social inclusion. *Environ Plan D*. 2007;25(3):537–61. <https://doi.org/10.1068/d67j>.
93. Barton J, Pretty J. What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environ Sci Technol*. 2010; 44(10):3947–55. <https://doi.org/10.1021/es903183r>.
94. Bratman GN, Hamilton JP, Daily GC. The impacts of nature experience on human cognitive function and mental health. *Ann N Y Acad Sci*. 2012; 1249(1):118–36. <https://doi.org/10.1111/j.1749-6632.2011.06400.x>.
95. Hansmann R, Hug S-M, Seeland K. Restoration and stress relief through physical activities in forests and parks. *Urban For Urban Green*. 2007;6(4): 213–25. <https://doi.org/10.1016/j.ufug.2007.08.004>.
96. McNeill LH, Emmons K. GIS walking maps to promote physical activity in low-income public housing communities: a qualitative examination. *Prev Chronic Dis*. 2012;9:E17.
97. Evans GW, Lercher P, Kofler WW. Crowding and children's mental health: the role of house type. *J Environ Psychol*. 2002;22(3):221–31. <https://doi.org/10.1006/jevp.2002.0256>.
98. Weich S, Blanchard M, Prince M, Burton E, Erens B, Sproston K. Mental health and the built environment: cross-sectional survey of individual and contextual risk factors for depression. *Br J Psychiatry*. 2002;180(5):428–33. <https://doi.org/10.1192/bjp.180.5.428>.
99. Summers-Gabr NM. Rural-urban mental health disparities in the United States during COVID-19. *Psychol Traum*. 2020;12(S1):S222–4. <https://doi.org/10.1037/tra0000871>.
100. Fontanesi L, Marchetti D, Mazza C, di Giandomenico S, Roma P, Verrocchio MC. The effect of the COVID-19 lockdown on parents: a call to adopt urgent measures. *Psychol Traum*. 2020;12(S1):S79–81. <https://doi.org/10.1037/tra0000672>.
101. Hammell K. Engagement in living: critical perspectives on occupation, rights, and wellbeing. CAOT: Ottawa (Canada); 2020.
102. Townsend E, Wilcock AA, Christiansen C. Introduction to occupation: the art and science of living. New York: Prentice Hall; 2004.
103. Wagman P, Håkansson C, Björklund A. Occupational balance as used in occupational therapy: a concept analysis. *Scand J Occup Ther*. 2012;19(4): 322–7. <https://doi.org/10.3109/11038128.2011.596219>.
104. AOTI. Occupational therapy and the COVID-19 pandemic. 2020. Available from: <https://www.aoti.ie/news/WFOT-Occupational-Therapy-and-the-COVID19-pandemic%2D%2Dinformation-and-WFOT-resources104>. Accessed 27 November 2020.
105. Whiteford G. The call up: sharing our knowledge and skills to make a difference. *Connections*. 2020;17(2):13.
106. Hocking C. Invited commentary: an occupational perspective of population health in a pandemic. *NZ J Occup Ther*. 2020;67(2):4–5.
107. Podsakoff PM, MacKenzie SB, Lee J-Y, et al. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J Appl Psychol*. 2003;88(5):879–903. <https://doi.org/10.1037/0021-9010.88.5.879>.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.