

Meaningful Activities During COVID-19 and Association With Mental Health in Belgian Adults.

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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 between April 24 and May 4, 2020. 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 is positively related to adults' mental health. Insights from this study can be taken into account during future lockdown measures in case of pandemics.

Background

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

Epidemic diseases are a permanent threat to global health. COVID-19 is not the first epidemic that affects Belgium. In the past, Europe, including Belgium had to deal with (Mexican) influenza, smallpox, and the Black Plague. Nowadays, many infections such as smallpox and influenza can be prevented by vaccinations. In the last decades, Belgium was spared of life-threatening epidemics such as Severe Acute Respiratory Syndrome (SARS) in 2003 which had very similar symptoms of COVID-19 [5]. It is therefore the first time for the majority of the Belgian population that they 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 Belgium, with a population of about 11 million (reported on

June 2nd, 2020), still more than 15000 COVID-19-related deaths, e.g. 174 deaths per day per million inhabitants, were reported [7].

Research has shown that epidemics can cause severe and variable psychological effects on people [8]. The growing literature about COVID-19 showed already that the pandemic and accompanying measures have a profound effect on – besides health issues – all aspects of society, including mental health [9, 10]. Since mental health issues in times of COVID-19 are now among the foremost public health concerns throughout the world, it is one of the most researched topics [11]. Most of the mental health-related studies during COVID-19 were focusing on caregivers, such as nurses and physicians, who are on the frontlines of the pandemic responses [12–16] or the mental health of COVID-19 patients [17].

COVID-19 and mental health is to date a rapidly growing field of research. The results are fragmented and a clear picture is missing. Several mental health studies in COVID-19 found associations between demographical characteristics and mental health. It seems that younger ages (< 30 years, inclusive students [18, 19]) [12, 20–24], women [12, 18, 19, 21, 25], healthcare workers [12, 20], unemployed people [18], adults who have children [26, 27], living rural [28], having cancer or chronic diseases [22] and living alone [22] are at highest risk to develop mental health problems such as anxiety or depression during the COVID-19 crisis.

So far none of these mental health-related studies during COVID-19, took the role or potential influence of one's daily meaningful activities on adults' mental health into account, although the lockdown had a major impact on persons daily activities [29]. Notwithstanding, previous research showed that daily activities can have a huge impact on one's mental health [30–35].

Moreover, activity engagement has been associated with fewer mental health symptoms due to the meaning people attribute to their daily activities [36–40]. 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 [41], well-being [42, 43], and aging successfully [44–46]. 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 five months of exposure to the COVID-19 pandemic [21].

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 relation between mental health and meaningful activities during the lockdown. Therefore, this study aimed to examine if meaning in activities was associated with mental health, regardless of demographics and personal characteristics (e.g., resilience).

The hypothesis (H) of this study is that the inability to engage in meaningful activities during COVID-19 lockdown is a contributing factor for low mental health. Specifically, we expect 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 was adherent to the strengthening of the reporting of observational studies in epidemiology (STROBE) statement [47].

Procedure and participants

The first lockdown measures in Belgium were elapsed on March 13, 2020, comprising (1) primary schools, high schools, and Universities had to close and turned digital; (2) all not-essential shops had to close, only nutritional 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, sports events were cancelled; (5) recreational settings such as cinema, fitness, had to close; (6) it was forbidden to see family and friends outside their own house and to undertake social activities. These measures lasted till the 4th of May 2020 as the number of COVID-19 infections stabilized.

The web-based self-reported questionnaire was distributed online in Belgium (Flanders and Wallonia) between the 24th of April (six weeks after elapsing the total lockdown) and the 4th of May 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.

Measures

Three standardised 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 operationalisations 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 if 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 adulthood stages 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 activities were linked to the nine domains of the International Classification of Functioning and Disability and Health (ICF) [48].

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) I perform the activity 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) I perform 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 [49]. This widespread validated instrument is used by the government in (epidemiological) studies in Belgium [50–52]. It had a sensitivity of 83.4% and specificity of 76.3% [53]. Internal consistency of the GHQ in this study sample was calculated with the Cronbach's Alpha. Every item (e.g. *Have you been enjoying your regular, daily activities lately?*) 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 [53].

The Connor-Davidson Resilience Scale (CD-RISC). The CD-RISC measures the personal characteristic resilience, broadly conceptualized as healthy and adaptive functioning in the aftermath of adversity [54, 55]. 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 [56]. The CD-RISC is a widely recognized and well-validated measurement of resilience in different cultures [57] and populations [58]. In adults, the threshold score is 29 [59]. It showed a good convergent validity, accounted for high explained variance (81.5%) and overall correlation values on divergent validity were close to zero [60]. 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 [61] was used. This measure has been developed to assess aspects of activity meaning and emphasis activity's congruity with one's value system and its ability to fulfil basic needs

and mastery. The EMAS uses the broad term 'activities' which represents 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 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 ($r = .71$) 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 [49, 62]. 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 was conducted for describing the sample.

Step 1: Bivariate analysis

In preparation of the multivariate analysis and to identify significant correlates of mental health, all potential relevant variables retrieved from the survey were associated with mental health. Therefore, bivariate analysis through between-group differences in mental health (GHQ) regarding nominal and ordinal independent variables was evaluated by Mann-Whitney U tests (gender, having children, living area, informal caregiver, receiving care, living space) and Kruskal-Wallis tests (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 differ 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, a multivariate analysis through a hierarchical multiple linear regression analysis was used. All categorical variables with more than two 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 (demographical 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 they are considered insignificant variables.

Results

Descriptive results

Sociodemographic variables

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

Table 1
Overview 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
	High school & 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

Note: SD = Standard deviation.

Mean age (SD)	34.79 (16.8)		
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 other 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 caregiver	Yes	9.3	166
	No	90.7	1615
Receiving informal care	Yes	6.1	108
	No	93.9	1673
Note: SD = Standard deviation.			

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. Approximately, two-third of the students who did a student job and nearly fifty percent of the adults who volunteered before the COVID-19 crisis had to quit these activities. Activities that continued indoors, alone or in the 'bubble' with closest family, such as leisure time (97.3%), caring of the family (99.4%), household (99.3%), doing chores in the house (98%) and self-care (99.8%), were largely retained.

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

	'Don't do anymore'	'Still do'
	Participants who discontinued activities	Participants who maintained the activities
Self-care (n = 1754)	0.2%	99.8%
Free time activities indoors (n = 1697)	2.7%	97.3%
Social activities outdoors (n = 1619)	37.4%	62.6%
Household (n = 1616)	0.7%	99.3%
Free time activities outdoors (n = 1473)	17%	83%
Caring for my health through sports (n = 1436)	3.7%	96.3%
Caring for my health through cooking (n = 1351)	2.7%	97.3%
Sexuality (n = 1255)	13.1%	86.9%
Attending a training (n = 945)	4.6%	95.4%
Doing chores in and around the house (n = 841)	2%	98%
Going to work (n = 792)	6.4%	93.6%
Caring for the family (n = 515)	0.6%	99.4%
Caring for others outside the family (n = 465)	18.5%	81.5%
Volunteering work (n = 401)	48.9%	51.1%
Caring for my health through mental activities (n = 385)	7%	93%
Student job (n = 326)	68.4%	31.6%
Doing chores for other people (n = 169)	39.6%	60.4%
Religious activities (n = 92)	12%	88%
Note: n = number of participants who performed the activity before the COVID-19 crisis		

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

(68%), sexual activity (83%), doing the household (79%), doing chores in the house (61%) and performing student jobs (82%) did not happen any differently than prior the COVID-19 outbreak.

However, other daily activities such as sports (48%), religion (56%), attending a training (66%), going to work (65%) were still performed but largely in a different environment. Adults social outside activities (70%), attending a training (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 caring for their health through sports, and 36% of the participants performing social activities prior to the COVID-19 outbreak report that they replaced these daily activities through other but still comparable activities evoking the same purpose or meaning.

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 (n = 1750)	61%	15%	22%	16%
Free time activities indoors (n = 1651)	44%	29%	22%	29%
Social activities outdoors (n = 1015)	11%	40%	70%	36%
Household (n = 1603)	79%	7%	13%	7%
Free time activities outdoors (n = 1226)	16%	69%	56%	10%
Caring for my health through sports (n = 1383)	32%	48%	34%	35%
Caring for my health through cooking (n = 1317)	68%	20%	15%	7%
Sexuality (n = 1085)	83%	4%	10%	5%
Attending a training (n = 902)	6%	66%	84%	4%
Doing chores in and around the house (n = 824)	61%	17%	27%	8%
Going to work (n = 741)	23%	65%	31%	2%
Caring for the family (n = 513)	56%	15%	23%	23%
Caring for others outside the family (n = 382)	25%	32%	55%	4%
Volunteering work (n = 205)	27%	39%	48%	12%
Caring for my health through mental activities (n = 358)	46%	23%	26%	29%
Student job (n = 106)	82%	6%	8%	4%
Doing chores for other people (n = 102)	37%	24%	40%	18%
Religious activities (n = 81)	37%	56%	26%	7%

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), CD-RISC (Cronbach's alpha = .883), and showed for every instrument a good to excellent internal consistency.

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

distress.

Participants scored on average 24.85 on the CD-RISC which means 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, living space. The results are displayed in Table 4. Woman scored significantly higher in the GHQ than men ($p < .001$) which indicate 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 the urban living area had lower mental health than participants who lived in the rural area ($p = .004$). Participants whose living space consisted of a garden or balcony had a lower score in the GHQ which reflects greater mental health ($p < .001$).

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	15.44 (6.80)	230410	-6.909	< .001
Woman	13.04 (6.55)			
Men				
Having children	12.89 (6.58)	258587	-9.364	< .001
Yes	15.84 (6.72)			
No				
Living area	14.44 (6.71)	356404	-2.909	< .05
Rural	15.41 (6.92)			
Urban				
Informal caregiver	15.65 (6.90)	123306	-1.704	.088
Yes	14.77 (6.80)			
No				
Receiving care	16.14 (7.40)	81136	-1.779	.075
Yes	14.77 (6.77)			
No				
Living space	14.62 (6.67)	91852.5	-4.06	< .001
Balcony/garden	17.50 (7.9)			
No balcony/garden				
Note: higher scores in GHQ means lower mental health				

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.

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
Marital status	12.54 (0–36; 6.18)	11 (9)	< .001	.033 between 1* and 2
1.Married		15 (11)		
2.Divorced	14.74 (3–32; 7.08)	16 (10)		< .001 between 1 and 3
3.Alone	16.56 (1–36; 6.79)	13 (7)		< .001 between 1 and 5
4.Widow		13 (10)		
5.Living together	12.91 (1–23; 5.61)	16 (10)		< .001 between 1 and 6
6.Other	14.17 (0–36; 6.73)			.019 between 3 and 4
	16.07 (2–35; 6.81)			< .001 between 3 and 5
				.001 between 5 and 6
Educational level	12.3 (4–20; 5.74)	10.50 (11)	.156	
Primary education		14.50 (11)		
Secondary education	15.44 (1–35; 7.17)	14 (10)		
Higher education	14.69 (0–36; 6.71)			
Employment status	16.67 (1–36; 6.80)	16 (9)	< .001	< .001 between 1 and 2
1.Student		12 (9)		
2.Employed	13.16 (0–34; 6.25)	12 (9)		< .001 between 1 and 3
3.Not employed	13.78 (1–36; 6.90)			

Note: To increase the interpretability, means as well as median were displayed in this table. Higher scores in GHQ means lower mental health. *The numbers in the last column correspond with the groups described in column 1.

	GHQ Mean (Range; SD)	GHQ Median (inter quartile)	P-value Kruskal Wallis	P-value Mann- Whitney U
Living condition	15.19 (2– 35; 7.30)	14 (11)	< .001	.002 between 1 and 3
1.Alone		15 (10)		
2.Alone with children	14.29 (1– 29; 6.97)	12 (9)		.001 between 1 and 4
3.Living together without children	13.09 (0– 36; 6.23)	11.5 (9)		.025 between 1 and 5
4.Living together with children	12.83 (0– 36; 6.47)	16 (10)		.001 between 1 and 7
5.Living in with parent(s),family	16.36 (1– 36; 6.50)	22 (13)		.004 between 2 and 7
6.Room alone	19.27 (5– 36; 8.37)	13 (11)		< .001 between 3 and 5
7.Room together				.003 between 3 and 6
8.Other	19.34 (3– 35; 8.01)			
	14.88 (3– 34; 7.96)			< .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	14.88 (0– 36; 6.80)	14 (11)	.545	
Flanders		14 (11)		
Wallonia	14.81 (3– 34; 7.53)	12 (10)		
Brussels	13.68 (2– 32; 6.95)			

Note: To increase the interpretability, means as well as median were displayed in this table. Higher scores in GHQ means lower mental health. *The numbers in the last column correspond with the groups described in column 1.

	GHQ Mean (Range; SD)	GHQ Median (inter quartile)	P-value Kruskal Wallis	P-value Mann- Whitney U
Working situation	13.36 (0–33; 6.44)	13 (10)	.504	
Working from home		11 (8)		
Work as usual	12.92 (4–30; 5.46)	13 (10)		
Technically unemployed	14.74 (4–34; 7.54)	13 (8)		
Other	14.28 (0–36; 7.58)			
Health condition	14.63 (0–36; 6.66)	14 (10)	< .001	.011 between 1 and 2
1.Healthy		16 (11)		
2.Acute ill	17.02 (2–31; 6.99)	14 (10)		.001 between 1 and 4
3.Chronically ill	15.06 (3–36; 7.09)	20.50 (11)		.042 between 2 and 3
4.Mentally ill	20.23 (2–36; 9.17)			.003 between 3 and 4
Note: To increase the interpretability, means as well as median were displayed in this table. Higher scores in GHQ means lower mental health. *The numbers in the last column correspond with the groups described in column 1.				

Being married scored significantly lower in the GHQ than being divorced ($p = .033$), being alone ($p < .001$) and living together ($p < .001$) which indicate 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 ($p < .001$), meaning 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 in with parent(s) or family scored higher in the GHQ than living alone ($p = .025$), 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 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 acute ill participants ($p = .011$) or mentally ill participants ($p < .001$), meaning better mental health. Chronically ill persons scored lower in the GHQ than mentally ill participants ($p = .003$) and acute ill participants ($p = .042$), meaning better mental health.

As shown in Table 6, Spearman's Rho test showed a significant moderate relation 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 ($R_s = -.254, p < .001$).

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

VIF factors showed no problem in multicollinearity, except for 'living condition' and 'marital status' that reflect both whether or not they 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 explaining the same, 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 predictors at once which 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 at once into Model 1 and accounted significantly together 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 ($\beta = -.332; p < .001$).

Table 7
Hierarchical regression analysis of demographical, 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**
Notes: **significant result ($p < .001$), *significant result ($p < .05$)						

Discussion

To gain insight into relevant components of mental health in Belgian adults during the COVID-19 lockdown, this study investigated some potential predictors of their mental health and focussed on the role of meaning in activities in particular.

We could confirm our hypothesis, stating 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 support of efforts 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 [63].

Based on the discussion of Allsop and colleagues [64], 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. Results of our study showed low mental health in Belgian adults. This is not unexpected as current COVID-19 research showed similar results. Using the same measure instrument GHQ, the researchers from the United Kingdom Household Longitudinal Study (UKHLS) [65] 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 in the first COVID-19 wave that 29.2% of their respondents scored above the threshold on the GHQ, which indicates a case of psychiatric disorders [66]. Furthermore, from April 2020 until June 2020, all sociodemographic groups showed significant increases in mental health problems in the UK [67].

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 [68–70]. As stated before, meaning in activities is a key outcome of human health and well-being and our study demonstrated that this also holds times of a pandemic where anxiety and stress prevail [41, 43].

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 one's day-to-day living, behaviour, and well-being might be blurred [4, 65]. People were forced to adapt their daily activities. Activities that could not easily be adapted had to be discontinued such as volunteering work, student jobs, and most affected of all, social activities outdoors [71]. At the start of the lockdown, people experienced the measures like a temporary disruption of the situation and people adapted themselves to the situation by trying to find new ways to experience meaning in the performed activities by changing the form of the activity or searching for other activities, or changing their time investment in their activities [72]. As the lockdown persisted, people struggled to find meaning and started to attribute the negative effects of the measures to features out of control of the person (e.g. people started blaming the government that the measures were too hard). Hereby assuming, based on an occupational therapy model, that the temporary disruption turned into experiences of deprivation in which the people are restricted from participation in necessary meaningful activities due to circumstances outside their control [73].

It can be presumed that the longer the COVID-19 pandemic lasted, the more difficult it was to remain satisfied with these activities, and the more people lost meaning in activities. Due to the imposed measures, the form in which people were forced to perform their activities was reduced to its basic

function (e.g. the function of shopping is to ensure oneself of the necessary ingredients to stay alive) [72]. People became task-oriented, yet were less to engage in creative thinking which is primarily driven primarily by enjoyment and meaning in the activities [74, 75]. Consequently, the form of the activities did not leave enough room for aspects of meaning, such as shopping together for fun. Therefore, this could be an explanation of why most of the participants experienced moderate meaning in activities.

Next to the largest contribution of meaning in activity, resilience was the second strongest contributor to mental health. 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 [76]. Therefore, being resilient can protect against these events and thrive from adversity [77–79]. In a COVID-19 study across healthcare and non-healthcare professionals, higher resilience scores were associated with lower COVID-19 related worries. Moreover, higher scores on resilience were associated with a reduced rate of anxiety and depression [13].

Furthermore, 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 [12, 18, 19, 21]. Females' sense of identity in activities is more affected by the social connections formed rather than by other aspects in the activity setting [80]. Women seem to attach more meaning to social activities and these 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 the lockdown. Moreover, the care and household tasks, in which women are more active usually, interfered much more with the other activities than usual. In Belgium, parenting adults could request corona leave to manage the care of the (home-schooled) children. Seventy-five percent of the parents who claimed the leave appeared to be women [81]. In general, women were found more susceptible to mental related symptoms than men because they show greater emotional responses [26]. It can be concluded that women were found to be slightly more vulnerable in mental health than men.

It seems that being married in COVID-19 helped 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 [82, 83]. It can be explained by the importance of satisfaction and support associated with such a dedicated relationship [84]. Our study results suggest that living alone can cause lower mental health in the COVID-19 crisis compared to adults who are widows or living together. Previous research confirmed that living with a partner is a protective factor for general psychiatric disorders during the COVID-19 crisis [66].

Next, our study results demonstrated that chronically ill adults need to have specific attention in this study. They are less affected in mental health during the COVID-19 lockdown compared to mentally and acutely ill adults. Moreover, it is remarkable that chronically ill persons even did not differ statistically significantly 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 and may therefore be better able to cope with this crisis [85, 86].

To our knowledge, living space is not yet 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 go working if telework was not possible. People who lived in a house with a garden or in an apartment with a balcony, could go outside and perform some physical or psychological activities in the garden or on the balcony. It is already proven that (physical) activities in outdoor space protect against mental health problems and restricted access is likely to have negative implications for mental health [87–95]. People who had not the possibility to go outside their house (e.g. no garden or balcony) might have experienced deprivation and this 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 inhabit alters mental health correlates [96]. 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 [96]. A London study in low-income housing areas showed that having less access to private gardens is associated with a higher prevalence of depression [97].

Even though we found a statistically significant bivariate association between living area (rural living versus urban living) and mental health in our study sample of adults, living area was not a significant contributor for mental health in the multivariate analysis. This suggests that its explanatory power with regard to one's mental health is limited compared to the other included predictors. Living in a rural area gave better mental health during COVID-19 lockdown than living in an urban area according to the study results. Living in a rural area gives opportunities to take long walks outdoors, being in nature, which positively promotes mental health [87–95]. However, this is contradicted in the study of Summer-Gabr [98] 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 one's 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 influence one's mental health stronger.

Finally, participants without children had lower mental health than adults with children. This is contrary to what the current literature stated. A national COVID-19 study in de US explained the low mental health in parents by the fact that parents reported worsening behavioural health for their children [27]. Unstable financial circumstances, school closure, suspended educational services for children may underlie low mental health in parents [99]. Our contrary results could be due to the fact that most of the participants who did not have children in our study, were students.

An unexpected result is that work status was not significantly associated with mental health in the multivariate analysis, despite their bivariate association. COVID-19 studies showed already that unemployed adults and students have more chance to be exposed to mental health problems [18, 66].

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 regarding their mental health. These results might reflect that students are a vulnerable subgroup during COVID-19 lockdown. Alternatively, employment, like we measured in our study, might be a too generic variable that neglects the type of job one performs or its job characteristics. It might be that one's mental health is more influenced by the extent of remote working and its interference with one's daily functioning at home.

Remarkably, educational level was not significantly related to mental health in our study. This contradicts previous studies that showed that people with higher degrees (above bachelor's level) experienced an increase in mental health problems at the time of the pandemic [25, 67]. Probably our result might be due to range restriction, as indeed the majority (76.6%) of our participants held a higher educational degree (High school or University).

Nevertheless, our study demonstrated that maintaining or reconstructing meaningful activities in people during the COVID-19 pandemic seems to be an important pathway to reconstruct a meaningful life in the context of profound disruption [100]. Improving awareness among people and authorities of the importance of meaningful activities in daily lives might lead to more widespread recognition of the potentially detrimental effects of activity disruption and deprivation when these occur [101] and the appreciation of people's participation in meaningful activities.

The impact that isolation and lockdown due to COVID-19 have on people's ability to achieve a sense of occupational balance, defined as a balance of engagement in occupations that leads to well-being [102], is alarming. Consequently, occupational therapists have a critical role to play in helping people respond to the COVID-19 pandemic [103]. Profession leaders have articulated the relevance of our profession in supporting mental health and wellbeing in populations worldwide [100, 104, 105]. Occupational therapists already learned a lot from their clients about how everyday lives might be rebuilt within constraining parameters out of the control of the clients. Our unique occupational focus can be central in identifying new and creative solutions in response to the unprecedented and challenging COVID-19 crisis. Occupational therapists 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 including mental health [103]. 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 that considered a comprehensive set of factors that might contribute to adults' mental health, and in particular, identified meaningful activities as a plausible key predictor of one's mental health.

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 get out of the lockdown in a sustainable way and from a social perspective, to maintain peoples' mental health. Policymakers should be aware that besides economical and health aspects, meaning in activities is also a pillar to be taken into account throughout COVID-19 decision-making processes and measures.

Methodological considerations / limitations

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

Secondly, 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 [65].

Thirdly, 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.

Finally, exclusively self-reported measures were used in this study. These measures can cause common method variance, which can influence results [106]. 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.

List Of Abbreviations

COVID-19	Corona Virus Disease
WHO	World Health Organisation
SARS	Severe Acute Respiratory Syndrome
H	Hypothesis
STROBE	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

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.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. All methods were carried out in accordance with relevant guidelines and regulations.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

DVP and VDVD were the main promoters of the first author, made substantial contributions throughout the research, helped in the interpretation of data, helped to create the web survey, improved writing, approved submitted version and agreed both to be personally accountable for the author's own contributions.

DLM, VP, CP, DPR, OK made substantial contributions throughout the research, helped to analyze the data, helped to create the web survey, improved writing, approved submitted version and agreed both to be personally accountable for the author's own contributions.

SA helped translating the web survey, improved writing, helped to create the web survey, approved submitted version and agreed both to be personally accountable for the author's own contributions.

RBM, MBJA, FSAJ, VML helped to translate and create the web survey, improved writing, approved submitted version and agreed both to be personally accountable for the author's own contributions.

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