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Research paper

# COVID-19 and people who use drugs: Impact of the pandemic on general anxiety and depressive disorders among adults in Belgium

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## ABSTRACT

**Background:** During previous pandemics people who use drugs (PWUD) were categorized among the most vulnerable. In the current study, firstly, we wanted to evaluate the impact of the COVID-19 crisis on the prevalence of anxiety and depressive disorders among PWUD. Furthermore, we wanted to compare the prevalence of these disorders with that of members from the general population who did not use drugs.

**Methods:** We used a matched cohort design based on two separate repeated cross-sectional online surveys (April and November 2020) among PWUD and the general population. Results of GAD-7 and PHQ-9 were used as outcome variables. We calculated absolute and relative risks for matched pairs for both affective disorders, and logistic regression to compare affective disorders over both waves for PWUD.

**Results:** In April, the prevalence of affective disorders was similar for PWUD and the general population. In November, the risks for anxiety disorders increased with 64% for PWUD compared to non-PWUD (RR = 1.64, 95%CI 1.42–1.88), whereas the risks for depressive disorders more than doubled (RR = 2.29, 95%CI 1.97–2.67). Having a job and being male were protective factors for PWUD for both anxiety and depressive disorders.

**Limitations:** As this study used self-reported data, GAD-7 and PHQ-9 give an indication of the presence of anxiety and depression which might differ from a clinician's judgement.

**Conclusions:** PWUD might be disproportionately affected by COVID-19. Health care providers should be attentive to substance use as an indicator for increased risk of mental health problems.

## 1. Introduction

In December 2019 a new type of coronavirus, SARS-CoV-2, emerged in Wuhan City, China (WHO, 2020b). The principal transmission turned out to be similar to other respiratory diseases with infected people passing the illness to the people around them by coughing, sneezing and close social contact. Because of the high contamination risk and the importance of close social contact in the transmission of the virus, COVID-19 changed our way of working and our lifestyle. The initial recommendations from the health authorities focused on hygiene measures such as coughing and sneezing in the elbow and washing hands regularly. However, this proved to be insufficient to contain the spread of the disease. On March 11th 2020, the World Health Organization (WHO) declared COVID-19 a pandemic. On March 13th 2020 the Belgian government introduced strict confinement measures: shops and schools closed, wearing a mask became obligatory inside buildings,

social distancing of 1.5 meter was recommended and social contacts were strictly limited. Physical contact between people was absolutely discouraged. As a result, distance learning became the norm at schools and universities, some companies had to close down or shift towards telework and many people lost their jobs. In Belgium temporary unemployment rates were at 1,245,232 in April 2020, as compared to 104,404 in April 2019 (RVA, 2020).

By the end of May 2020 infection rates dropped and the confinement measures were lifted. Although COVID-19 still dominated social life, personal contact with other people was possible again in summer. However, starting from September 2020 the number of people infected by COVID-19 increased again and by the beginning of November 2020 strong restrictions in social and professional life were implemented again (Sciensano, 2020b).

Substantial literature is available about the impact of man-made or natural disasters on mental health in general (Leung et al., 2005;

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Pfefferbaum and North, 2020; Yzermans et al., 2005). However, the differences between the current pandemic and an earthquake, a tsunami or a terrorist attack are important: COVID-19 is not a local event, it affects the community as a whole, even worldwide, instead of a part of it; people have to live with a constant threat instead of facing the consequences of a sudden event; and some members of the community are more at risk for disease related complications than others (e.g. people with chronic diseases or people above 80) or for the socio-economic side-effects of the societal restrictions. As we know from similar previous epidemics, such as for the Severe Acute Respiratory Syndrome (SARS) in 2003, there is an increased risk for mental health problems, more specifically anxiety, mood and thought disorders, adjustment disorders, and post-traumatic stress disorders (PTSD) (Brooks et al., 2020; Leung et al., 2005; Liu et al., 2012; Pfefferbaum and North, 2020). Soon after the current outbreak it became clear that the COVID-19 pandemic would also have a serious impact on the mental health state of the population (Chiappini et al., 2020; Kumar and Nayar, 2020; Rajkumar, 2020; Superior Health Council, 2020; WHO, 2020a). Indeed, those who became infected or seriously ill were confronted with the consequences of the infection, higher stress levels and anxiety. Those working in the health and social care sector had to face high job demands, an atmosphere of higher threats and potentially the psychological impact of being forced to make hard choices that contradicted the ethical norms. Others were challenged by the consequences in social and professional life due to the restrictions of the confinement measures (Hotopf et al., 2020).

Besides, comorbidity between substance use and mental health problems, in particular anxiety and depression, is well documented (National Institute on Drug Abuse, 2020; Rush et al., 2008). During previous SARS-like pandemics, studies showed that people with substance use disorder (SUD) were among the most socially and medically vulnerable groups (Pfefferbaum and North, 2020), which was very soon confirmed for the COVID-19 pandemic as well (ECDC, 2020; Pierce et al., 2020).

The question remains if people who use drugs occasionally or opportunistically, and hence meaning those who or not dependent from it nor in treatment for SUD, from here on called recreational drugs users, could be disproportionally affected by the consequences of the pandemic. Indeed, many of them tend to be in the younger age categories, characterized by many social contacts, new experiences and an exciting night life where, for most of them, going out plays an essential role (Mey et al., 2018). Though the drug market proved to be resilient to the crisis (EMCDDA, 2020), their lifestyle became nearly impossible to maintain after the implementation of the restrictive measures, or shifted towards an illegal or underground scene. We expected that these changes in lifestyle affected the mental health of PWUD differently from the mental health of members from the general population who did not use drugs.

In the current study, firstly, we wanted to evaluate the impact of the COVID-19 crisis on mental health of PWUD and estimate the proportion among them with anxiety and depressive disorders. Secondly, we wanted to compare the prevalence of these disorders with that of members from the general population who were not using drugs. Our hypotheses was that the psychosocial impact of (the measures related to) COVID-19 would be more severe in PWUD than in the general population.

## 2. Methods

To better understand the impact of COVID-19 on mental health for PWUD and for non-drug using members of the general population, we used two separate cross-sectional online surveys. One survey targeted PWUD, representing the source population of this study. They were defined as people of 18 years or older, living in Belgium, who used street drugs in 2020 and gave their consent to participate in an online survey. A second online survey had a broader scope and was open to the general population. The respondents for this survey met the same inclusion

criteria as the PWUD, except for what concerned illicit drug use in 2020. Although both surveys were organized separately, they took place within a similar time frame, used the same questions and answer categories for the socio-demographic profile of the respondents, and the same scales to measure anxiety and depressive disorders.

Respondents from both surveys were recruited through convenience sampling, using (social) media advertisement, snowball sampling and contacts with health services and grass root organizations, to participate in the online surveys. In the promotion of the survey towards PWUD, we explicitly mentioned the use of illicit drugs in 2020 as a specific inclusion criterion. However, for the general public survey, we did not mention illicit drugs among the inclusion or exclusion criteria. The online questionnaires were developed in LimeSurvey (LimeSurvey Project Team/Carsten Schmitz, 2020) and available in four languages (Dutch, French, German and English).

Since we expected that mental health problems might increase over time because of the duration of the COVID-19 crisis, six months after the first survey period (April 2020) another online survey was launched among both the general public and PWUD, following the same recruitment channels. For practical reasons it was not possible to organize the surveys for the general population and for PWUD at exactly the same moment, but the differences in results because of these different time frames were expected to be minimal. The two data collection waves for PWUD were held from April 3rd to April 16th 2020 (wave 1) and from October 21st to November 6th 2020 (wave 2). The two waves for the general population were organized between April 2nd and April 9th 2020 (wave 1) and between September 24th and October 2nd 2020 (wave 2). Although participants in the first wave were invited to leave their e-mail address to be contacted again at a later stage, only 154 respondents in the PWUD sample (3.6%) did so. As a result, most of the second wave respondents were different from those of the first wave and a matched-pair longitudinal study was impossible.

For PWUD, apart from the questions regarding the inclusion criteria, one additional question battery was mandatory. This question battery asked about lifetime use, last year use and last month use of alcohol, cannabis, cocaine, amphetamines, methamphetamine, ecstasy/MDMA, ketamine, LSD, GHB and heroin. The rest of the questionnaire focused on the use of each substance separately with questions regarding the quantity used, mode of consumption, price and availability. For the survey among the general population, a question battery was added regarding lifetime use, last year use and last month use of illicit substances in general, in order to ensure that PWUD would be matched to respondents from the general population who were not PWUD. Furthermore, in both surveys we asked questions about people's intentions to follow the confinement measures and their personal experience with COVID-19.

To measure people's mental health state, we used two internationally standardized instruments: the General Anxiety Disorder scale (GAD-7) and the Patient Health Questionnaire (PHQ-9). The GAD-7 is one of the most frequently used diagnostic self-report scales for screening, diagnosis and severity assessment of anxiety disorders. It is based on seven items which are scored from zero to three and a sum score ranging from 0 to 21. A sum score of 10 represents a moderate anxiety level (Spitzer et al., 2006). At this cut-off score sensitivity, specificity and internal consistency exceed 0.8 (Spitzer et al., 2006; Williams, 2014). The PHQ-9 is a self-administered questionnaire which scores each of the 9 DSM-IV criteria for depression as "0" (not at all) to "3" (nearly every day). Previous studies have shown that the sensitivity, specificity and internal consistency of the PHQ-9 is within a reliable range (Kroenke et al., 2001). For both GAD-7 and PHQ-9, if three or more items were unanswered the respondents were excluded from the analysis. For one or two missing answers, the mean score of the other items was used to calculate a total score.

A first analysis focused on a comparison of the unmatched data. For this, numbers and proportions were used to describe the database of unmatched PWUD and the respondents from the general population who

do not use drugs for both waves. However, because of the significant difference between both samples in terms of age, sex and region of residence, we used a matched cohort design in order to compare the impact of COVID-19 on mental health for PWUD with the impact on non-drug using members of the general population. For both waves, every PWUD was a posteriori matched on wave, age, sex and region of residence to one respondent from the general population who did not use drugs. Indeed, the uneven distribution over age and sex for PWUD and respondents from the general population justified this matched study design. Region of residence was used as a matching variable to exclude potential cultural difference between the Belgian Communities. Only respondents who had answered both GAD-7 and PHQ-9 questions, and for whom data about age, sex and region was available, were selected for matching. PWUD could participate in the survey among the general population but were excluded afterwards on the condition that they had used illicit drugs in the last year.

The characteristics for matched pairs are described for both waves by numbers and proportions. We also report absolute and relative risks for the affective disorders. Furthermore, to get a better understanding of risk and protective factors for having a general anxiety or depressive disorder among PWUD, we looked at the matched PWUD in wave 2 and conducted a univariable regression analysis with each term of interest (demographics, last year drug use and polydrug use) separately and then entered the significant items into a multivariable model on which we applied backward elimination to get a final best-fitted model. For all regression models, the odds ratios are reported with 95% confidence intervals (CI). For the final model, we also provide the Hosmer and Lemeshow Goodness-of-Fit test and the area under de ROC curve. Statistical analysis was performed using SAS software version 9.4 (SAS Institute Inc., Cary, NC). The reporting of this study conforms to the STROBE guidelines (Vandenbroucke et al., 2007).

### 3. Results

In wave 1, 49,335 respondents from the general public and 3,509 PWUD participated in the surveys (Table 1). In wave 2, they were respectively 30,845 and 2,354. For PWUD, more men than women participated (78.0% in wave 1 and 71.5% in wave 2), whereas for the general population, men were a minority (31.8% in wave 1 and 36.5% in wave 2). For PWUD, 54.6% of the respondents in wave 1 and 45.7% of those in wave 2 were under 25, compared to only 5.7% of the respondents from the general population in wave 1 and 2.3% in wave 2. The mean age difference between PWUD and respondents from the

general population was for each wave approximately 20 years.

In wave 1, 45.5% of the PWUD could be matched to a respondent from the general population. In wave 2, this was 53.2%. This means that we included 1,596 PWUD in wave 1 and 1,252 PWUD in wave 2, which gives a total of 2,848 PWUD. As every PWUD was matched to exactly one respondent from the general population, this results in a total sample of 5,696 respondents. In Fig. 1, a flow diagram illustrates the selection of unmatched and matched participants.

As shown in Table 2, the profile of subjects in the matched cohort study was very similar in both waves. They were mainly male (71.7% in wave 1, 61.8% in wave 2), from Flanders (78.3–78.5%) and younger than 35 years (74.9–73.8%). Average age was 29.2 years in wave 1 and 30.5 years in wave 2. Between 68.6 and 76.0% had a paid job, while between 12.9 and 26.7% was studying.

Respondents from the general population were higher educated than PWUD: 65.8% (wave 1) and 79.3% (wave 2) of respondents from the general population had finished higher education, compared to only 40.9% (wave 1) and 51.0% (wave 2) of the PWUD. 79.3% of the PWUD in wave 1 and 74.0% of the PWUD in wave 2 had used cannabis in the last 30 days. In wave 1, 19.9% of the PWUD had used cocaine, whereas in wave 2, this was 24.1%.

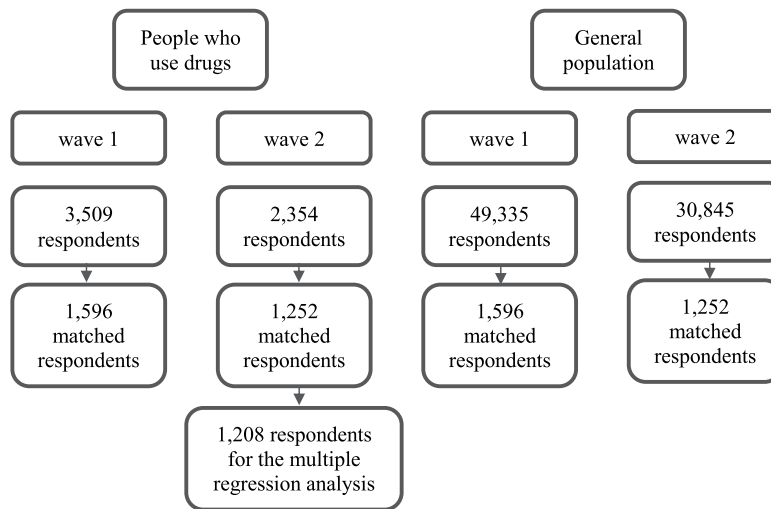
As shown in Tables 2 and 3, in wave 1, general anxiety disorders and depressive disorders were not or only slightly significantly different for PWUD and respondents from the general population with a prevalence between 20.3 and 24.6%. However, in wave 2, PWUD reported significantly more general anxiety and depressive disorders compared to respondents from the general population. For respondents from the general population, 19.3% reported a general anxiety disorder whereas 14.8% reported a depressive disorder. For PWUD, these percentages rose up to 31.6% for general anxiety disorders and 33.9% for depressive disorders.

In other words, the relative risk of a general anxiety disorder in wave 2 increased with 64% for PWUD compared to respondents from the general population (RR = 1.64, 95%CI 1.42–1.88), whereas the relative risk of a depressive disorder more than doubled for PWUD compared to respondents from the general population (RR = 2.29, 95%CI 1.97–2.67). For PWUD, the relative risk of an anxiety disorder in wave 2 increased with 56% compared to wave 1 (RR = 1.56, 95%CI 1.37–1.77), whereas for respondents from the general population the risks decreased slightly. Regarding depressive disorders, the relative risks for PWUD increased between the two waves with 38% (RR = 1.38, 95%CI 1.23–1.54), while the risks for respondents from the general population significantly decreased (RR = 0.70, 95%CI 0.59–0.82).

**Table 1**

Descriptive statistics of people who use drugs (PWUD) and the general population who were not using drugs in the 2020 COVID-19 online surveys in Belgium (unmatched data).

		PWUD				General population			
		wave 1		wave 2		wave 1		wave 2	
		N	(%)	N	(%)	N	(%)	N	(%)
Sex	Male	2,661	78.0	1,651	71.5	15,691	31.8	11,264	36.5
	Female	752	22.0	659	28.5	33,644	68.2	19,581	63.5
Region of residence	Flanders	2,520	77.3	1,811	81.0	31,796	64.5	21,126	68.5
	Brussels	337	10.3	222	9.9	4,872	9.9	2,881	9.3
	Wallonia	401	12.3	203	9.1	12,667	25.7	6,838	22.2
Age	18-24	1,905	54.6	1,068	45.7	2,807	5.7	705	2.3
	25-34	627	18.0	490	21.0	9,704	19.7	3,809	12.4
	35-44	358	10.3	323	13.8	11,967	24.3	6,397	20.4
	45-54	285	8.2	202	8.6	10,442	21.2	6,762	21.9
	55-64	168	4.8	119	5.1	8,872	18.0	7,303	23.7
	65+	147	4.2	135	5.8	5,543	11.2	5,969	19.4
Mean age ± standard deviation		26.7 ± 8.3		28.0 ± 8.9		45.7 ± 14.3		50.8 ± 14.0	
General Anxiety Disorder	yes	426	18.9	556	31.0	9,860	23.1	4,203	14.8
	no	1,831	81.1	1,238	69.0	32,859	76.9	24,273	85.2
Depressive Disorder	yes	503	23.9	614	35.3	7,093	16.9	3,117	11.1
	no	1,606	76.1	1,125	64.7	34,866	83.1	24,963	88.9
Total		3,509	100	2,354	100	49,335	100	30,845	100



**Fig. 1.** Flow diagram summarizing the recruitment of people who use drugs (PWUD) and the general population who were not using drugs in the 2020 COVID-19 online surveys in Belgium.

**Table 2**

Descriptive statistics of PWUD and respondents from the general population who were not using drugs in the 2020 COVID-19 online surveys in Belgium (data matched on wave, sex, age and region of residence).

		PWUD				General population			
		wave 1		wave 2		wave 1		wave 2	
		N	(%)	N	(%)	N	(%)	N	(%)
Sex	Male	1,144	71.7	774	61.8	1,144	71.7	774	61.8
	Female	452	28.3	478	38.2	452	28.3	478	38.2
Region of residence	Flanders	1,250	78.3	983	78.5	1,250	78.3	983	78.5
	Brussels	153	9.6	114	9.1	153	9.6	114	9.1
	Wallonia	193	12.1	155	12.4	193	12.1	155	12.4
Age	18-24	624	39.1	359	28.7	624	39.1	359	28.7
	25-34	571	35.8	564	45.1	571	35.8	564	45.1
	35-44	286	17.9	231	18.5	286	17.9	231	18.5
	45-54	97	6.1	71	5.7	97	6.1	71	5.7
	55-64	15	1.0	22	1.8	15	1.0	22	1.8
	65+	3	0.2	5	0.4	3	0.2	5	0.4
Mean age ± standard deviation		29.2 ± 8.9		30.5 ± 9.0		29.2 ± 8.9		30.5 ± 9.0	
Household type	Living alone, without children	335	21.1	334	26.8	170	10.7	158	12.6
	As a couple, without child(ren)	310	19.5	266	21.3	301	18.9	314	25.1
	As a couple, with child(ren)	169	10.7	147	11.8	345	21.6	301	24.1
	Living alone with children	36	2.3	43	3.5	25	1.6	10	0.8
	With my parent(s), family, friends or acquaintances	693	43.7	418	33.5	736	46.1	458	36.6
	Other	44	2.8	39	3.1	19	1.2	9	0.7
Employment status	Paid job	1,083	70.6	917	76.0	1,038	68.6	925	75.1
	Unemployment (not temporarily interrupted)	90	5.9	81	6.7	30	2.0	48	3.9
	Invalidity	26	1.7	22	1.8	15	1.0	11	0.9
	Studies	294	19.2	155	12.9	404	26.7	229	18.6
	Retirement	4	0.3	8	0.7	4	0.3	4	0.3
	Household work	7	0.5	4	0.3	4	0.3	5	0.4
	Other situation	31	2.0	19	1.6	18	1.2	10	0.8
Highest education	Secondary diploma or less	933	59.1	610	49.0	538	34.2	256	20.8
	Higher education	646	40.9	635	51.0	1,036	65.8	978	79.3
Drug use last 30 days	Cannabis (resin, weed)	1,265	79.3	926	74.0				
	Powder cocaine	318	19.9	302	24.1				
	Ecstasy/MDMA	199	12.5	212	16.9				
	Amphetamines (speed)	111	7.0	113	9.0				
	(Alcohol)	1,295	81.1	1,055	84.3				
Drug use last year but not last 30 days	Cannabis (resin, weed)	188	11.8	201	16.1				
	Powder cocaine	392	24.6	267	21.3				
	Ecstasy/MDMA	532	33.3	359	28.7				
	Amphetamines (speed)	159	10.0	101	8.1				
	(Alcohol)	194	12.2	120	9.6				
General Anxiety Disorder	Yes	324	20.3	396	31.6	365	22.9	242	19.3
	No	1,272	79.7	856	68.4	1,231	77.1	1,010	80.7
Depressive Disorder	Yes	393	24.6	424	33.9	338	21.2	185	14.8
	No	1,203	75.4	828	66.1	1,258	78.8	1,067	85.2
Total		1,596	100	1,252	100	1,596	100	1,252	100

**Table 3**

Relative prevalence of general anxiety disorders and depressive disorders for PWUD and respondents from the general population who were not using drugs, for both waves of the 2020 COVID-19 online surveys in Belgium (Relative risk (RR), 95 % confidence intervals (CI) and p-value for conditional maximum likelihood estimates).

		General Anxiety Disorder			Depressive Disorder		
		RR	95% CI	p-value	RR	95% CI	p-value
wave 1	General population	ref.			ref.		
	PWUD	0.89	0.78–1.01	0.09	1.16	1.02–1.32	0.02
wave 2	General population	ref.			ref.		
	PWUD	1.64	1.42–1.88	< 0.001	2.29	1.97–2.67	< 0.001
PWUD	wave 1	ref.			ref.		
	wave 2	1.56	1.37–1.77	< 0.001	1.38	1.23–1.54	< 0.001
General population	wave 1	ref.			ref.		
	wave 2	0.85	0.73–0.98	0.02	0.70	0.59–0.82	< 0.001

Multivariable logistic regression analyses in the sample of matched PWUD during the second wave of the survey showed that having a job and being male were protective factors for both general anxiety and depressive disorders, but household type was not (Table 4). In addition, being under 24 was a protective factor for depressive disorders, while a

**Table 4**

Univariable and multivariable logistic regression with backward elimination for people who use drugs for wave 2 of the 2020 COVID-19 online survey in Belgium (Odds ratios and 95 % confidence intervals (CI) with model estimates).

	General anxiety disorders		Depressive disorders	
	Univariable	Multivariable	Univariable	Multivariable
Living alone (vs. living as a couple or with parents)	1.00 (0.74–1.24)		0.89 (0.69–1.14)	
Age category 18–24 (vs. > 24)	0.69 (0.53–0.89)		0.50 (0.39–0.64)	0.66 (0.49–0.88)
Higher education (vs. Not higher education)	0.86 (0.67–1.09)		0.86 (0.68–1.08)	
With a job (vs. Jobless)	0.46 (0.35–0.61)	0.52 (0.39–0.68)	0.45 (0.35–0.60)	0.58 (0.44–0.78)
Male (vs. Female)	0.46 (0.36–0.58)	0.51 (0.39–0.66)	0.49 (0.38–0.62)	0.58 (0.45–0.74)
Flanders (vs. Brussels and Wallonia)	0.87 (0.60–1.24)		0.86 (0.60–1.22)	
Wallonia (vs. Flanders and Brussels)	1.29 (0.78–2.14)		0.93 (0.56–1.54)	
Used alcohol in last 12 months (vs. Not used)	1.25 (0.78–2.03)		0.88 (0.53–1.44)	
Used cannabis in last 12 months (vs. Not used)	1.24 (0.85–1.83)		1.07 (0.73–1.57)	
Used cocaine in last 12 months (vs. Not used)	0.89 (0.70–1.13)		0.98 (0.78–1.24)	
Used ecstasy/MDMA in last 12 months (vs. Not used)	1.01 (0.79–1.28)		0.88 (0.70–1.12)	
Number of illicit drugs used in last 12 months	1.06 (1.00–4.14)		1.09 (1.01–1.17)	1.11 (1.03–1.19)
Hosmer and Lemeshow Goodness-of-Fit test		<i>p</i> = 0.37		<i>p</i> = 0.28
Area under ROC curve		61.9%		63.6%

higher number of drugs used increased the risk on a depressive disorder. For anxiety disorders being under 24 was significant in the univariable model but this effect disappeared in the multivariable model. However, these results should be treated with caution since the value for the area under the ROC curve indicates that the model predicts the responses weakly (between 61.9 and 63.6%).

**4. Discussion**

As we know from previous disasters and outbreaks, most people are resilient and do not succumb to psychopathology in times of crisis. However, some groups such as people with preexisting medical, psychiatric, or substance use problems are more vulnerable to develop mental health pathologies than others (Pfefferbaum and North, 2020). To the best of our knowledge, the current study is the first to estimate the change in general anxiety and depressive disorders during the COVID-19 crisis among PWUD and to compare them with those who do not use drugs through two online surveys.

Online surveys are known to have many advantages such as their low cost and relatively easy set-up (Braekman et al., 2020). They are particularly commonly used to recruit populations such as PWUD as these are often considered hard to reach through traditional sampling methods without affecting the study results. A recently conducted research in the European nightlife scene concluded that online sampling shows a good overall representativeness of the results compared to offline sampling (Waldron et al., 2020).

Firstly, as this study compares the rates of general anxiety and depressive disorders among non-drug using members of the general population with rates for PWUD, it is important to assure that the results for the general population are reliable. The Belgian Health Interview Survey, which was a cross-sectional epidemiological study last conducted in 2018 and focusing on the health status, health behavior and health consumption of the general Belgian population, found general anxiety and depressive disorder rates of respectively 11 and 9.5%, using GAD-7 and PHQ-9 in exactly the same way as we did (Sciensano, 2020a). For the matched respondents from the general population these percentages rose at the beginning of the COVID-19 crisis to respectively 22.9% and 21.2%, and decreased again by October to 19.3 and 14.8% (Table 2). Our results are comparable with few other studies which have estimated the prevalence of general anxiety and depressive symptoms among the general public during the COVID-19 pandemic. Although difficult to compare because of cultural differences, a meta-analysis of studies conducted in China estimated the prevalence of anxiety and depression during COVID-19 between 16 and 28% (Rajkumar, 2020). In Austria, results based on the GAD-7 and PHQ-9 in a convenience sample showed general anxiety and depression levels of respectively 19 and 21% (using a cut-off for depression of 10 or higher instead of the diagnosis algorithm cut-off based on the guidelines for depressive disorder according to DSM-IV used in the current study) (Pieh et al., 2020). In the U.S., 30% of respondents in a general population study scored positive for anxiety and depression disorders during the pandemic (Twenge & Joiner, 2020). In the U.K., the prevalence of affective disorders was

found to be 18.9% in 2018–2019 and increased to 27.3% in April 2020 (Pierce et al., 2020). GAD-7 was also used in COVID-19 studies in New Zealand and in Germany with levels of anxiety reaching respectively, 15.6% and 16.8% of the samples (Bäuerle et al., 2020; Every-Palmer et al., 2020).

The results of the current study confirm that COVID-19 had a significant impact on the mental health state of the population in general. Particularly at the beginning of the crisis, one in five suffered from general anxiety and depressive disorders, which means twice as many people as before the crisis. Many people who previously coped well were during the crisis less able to cope because of the multiple stressors generated by the pandemic, and stress is known to be an important factor for both general anxiety and depressive disorders (Siqueira et al., 2001). Indeed, people had to live with a constant health threat, those who became infected or seriously ill were confronted with the consequences of the infection, some members of the community were more at risk for disease related complications than others (e.g. people with chronic diseases or people above 80). Besides there were the socio-economic side-effects of the confinement measures and the consequences in social and professional life due to the imposed restrictions (Hotopf et al., 2020).

Secondly, the comorbidity of substance use disorders and psychiatric morbidity has been well documented, but most research focused on either people with SUD, people in treatment for SUD or lifetime instead of current SUD (Lubman et al., 2007). Few studies looked at recreational drug use and current general anxiety or depressive disorders before COVID-19. In the UK, the national survey of psychiatric morbidity found a prevalence of 7.3% general anxiety disorders and 7.1% depressive disorders among drug dependent respondents, using different instruments than GAD-7 and PHQ-9 (Farrell et al., 2001). Similar results were found in Australia (Degehardt et al., 2001). Other studies in Europe focused on people with SUD or in treatment for SUD, with prevalence rates for general anxiety disorders ranging from 12 to 80% and for major depressive disorders from 17.0% to 55.8%, depending on the study design and the characteristics of the sample (EMCDDA, 2015). Peer-reviewed studies on the impact of COVID-19 on mental health for recreational PWUD are to the best of our knowledge not yet available.

In the current study, the prevalence of general anxiety and depressive disorders for the matched pairs were at the same level in April when confinement measures were introduced for the first time, but the relative risks of a general anxiety disorder six months later increased with 64% for PWUD compared to respondents from the general population, while the relative risks of a depressive disorder more than doubled for PWUD compared to respondents from the general population. The increase of these disorders among PWUD and the stable trend for the general population, although almost twice as high as before the COVID-19 crisis, might indicate that COVID-19 had a disproportional impact on the mental health of recreational PWUD compared to the general public. It clearly shows that the continuous restrictions on social contacts, night life and recreational activities had a devastating impact on mental health of recreational PWUD. Many of them lacked perspective, a clear time frame was missing and directives from the government were at times confusing or changing rapidly. Even more than before, it became obvious that young people, to which many recreational PWUD belong, need social contacts, new experiences and an exciting night life in which going out plays an essential role (Mey et al., 2018). On top of that, also other domains of daily life lost their usual structure such as school or family life. Although every part of society has suffered from the confinement measures, particularly the lifestyle of PWUD is incompatible with the restrictions imposed by public health needs. For some of them, drug use might also have been a coping mechanism for the disruption of pre-COVID-19 life patterns and relationships.

As the results of the logistic regression in the sample of matched PWUD during the second wave show, the odds were significantly lower for men than for women to report general anxiety (OR = 0.51, 95%CI 0.39–0.66) and depressive disorders (OR = 0.58, 95%CI 0.45–0.74).

Odds were also lower for PWUD who had a job compared to those who did not have a job. This has been reported before in studies within the general population (Altemus et al., 2014; Bäuerle et al., 2020; Every-Palmer et al., 2020; Van Droogenbroeck et al., 2018). Indeed, financial insecurity could play an important role in the development of general anxiety and depressive disorders. Moreover, for many people a job allows to structure the day. It is well known that a structured day is important for mental well-being (Burn and Mudholkar, 2020). The lack of a structured day in combination with reduced social contacts leads to higher levels of general anxiety and depressive disorders. At the same time, because of the lack of activities, also sleeping patterns are disturbed, which might lead to a vicious circle in which affective disorders could become predominant.

Interestingly, for PWUD living alone compared to living as a couple or with parents or friends was not significantly linked to the reporting of neither of the affective disorders. This might seem to be in contradiction to other studies which mentioned the importance of social isolation and loneliness in the development of mental health problems during COVID-19 (Palgi et al., 2020; Pietrabissa and Simpson, 2020). However, most of these studies focused on the feeling of loneliness rather than on the fact that people live on their own.

In general, the results of the study show that more attention should be paid to affective disorders, already before a crisis such as the COVID-19 pandemic arrives. Although the UN emphasized the importance of mental well-being as early as May 2020 (United Nations, 2020), the initial response to the crisis focused on damage control and saving lives. When the first confinement measures were announced, the impact on people's mental health was not a priority. Even more, many mental health services had to close down or they had to limit their response capacities. Not many psychologists or other mental health specialists were prepared or able to switch to online counseling. There is little doubt that low threshold psychological services should be further strengthened and improved in order to remain available in times of crisis. Particularly for hard to reach populations such as recreational PWUD, such services should remain accessible at all times.

Moreover, the results encourage communities to be more attentive for mental health: a better understanding of threats for affective disorders, facilitating the conversation on recreational drug use and the related supporting roles on several levels of the community-especially among peers, but also with parents or employers-are key for anticipation and early detection of the changes in behavior, including anxiety and depression. Also, the establishment of preventive mental health programs and activities with aim for increasing resilience, will allow to reduce psychological distress in general and in times of crisis in particular. Therefore, a better implementation of life skill development in educational settings has gained importance.

## 5. Limitations

There are methodological and contextual limitations to the current study. First of all, the analysis of the unmatched data shows that age and sex were significantly different for PWUD and members of the general population. Although the percentages for general anxiety and depressive disorders for the matched pairs are not very different from the unmatched data, this could not have been excluded in advance. Since it was our objective to study the impact of COVID-19 on mental health of PWUD compared to non-drug using members of the general population, age and sex had to be excluded as potential confounders. Also, as said before in the current survey among the general population, PWUD could participate but were excluded afterwards on the condition that they had used illicit drugs in the last year. Post-hoc analysis of the subpopulation of PWUD in the general survey, which consisted of only between 2.7% (wave 1) and 2.8% (wave 2) of the total sample, showed a mean age of 36.2 years (wave 1) and 39.5 years (wave 2). This is between 7 and 9 years higher than participants which were included in the current study.

Secondly, the results of our study are based on self-reported data.

Although GAD-7 and PHQ-9 are instruments with internationally validated scales, they can be different from the judgement of clinicians when they face the respondent in their practice. These instruments only give an indication of the presence of anxiety and depression, with individual differences, particularly for people close to the cut-off values.

Thirdly, in wave 2, there was a considerable time gap between the survey among the general population and the PWUD, related to practical obstacles. This could have had an influence on the data for wave 2, particularly since the new confinement measures were announced in the last days of the survey among the PWUD. Still, it is unsure if this delay could explain the big increase for PWUD compared to the general population.

Fourthly, ideally the same people would have been interviewed in wave 1 and wave 2 to evaluate the direct impact of COVID-19. This would have allowed to examine how affective disorders would have changed throughout the COVID-19-crisis. Within the current study design it was only possible to estimate the prevalence of affective disorders on population level at the beginning of the COVID-19-crisis and six months later, and to compare the results for PWUD with non-drug using members of the general population. We cannot exclude that for some PWUD anxiety and depressive problems decreased since the beginning of the pandemic and it would be interesting to see which indicators could explain this change. Moreover, we cannot exclude that some respondents were people with SUD. Indeed, in wave 1 we also asked about treatment history for SUD: 7.5% had ever been in treatment for SUD, while 3.0% was in treatment at the moment of the confinement. Since we did not ask the question in wave 2 we couldn't exclude these respondents from the analysis. However, there is no reason to assume that their share in the total sample was such that could explain the big increase in affective disorders between wave 1 and 2.

The main contextual limitation of the current study is that it remains unclear if and how the change in affective disorders has influenced drug use by the respondents. The use of drugs did not explain the rise in the prevalence of affective disorders for PWUD (Table 4), but it was not possible to analyze the opposite. Indeed, it might be that the increase of anxiety and depressive disorders did influence drug consumption or that drug consumption was a way to cope with rising feelings of anxiety and depression. Further research should look into the change in drug use because of increased anxiety and depressive disorders.

### Authorship and copyright

All authors confirm that the submitted manuscript is an original contribution and has not been previously published, that it is not under consideration for publication elsewhere, and that, if accepted, will not be published elsewhere in similar form in any language.

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### Ethical standards disclosure

The survey was approved by the Human Ethics committee of Ghent University Hospital.

### CRedit authorship contribution statement

**Luk Van Baelen:** Visualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Lies Gremeaux:** Writing – review & editing. **Jérôme Antoine:** Conceptualization, Data curation, Writing – original draft, Writing – review & editing. **Helena Bruggeman:** Validation, Writing – original draft, Writing – review & editing. **Lydia Gisle:** Conceptualization, Data curation, Writing – original draft, Writing – review & editing. **Els Plettinckx:**

Conceptualization, Data curation, Writing – original draft, Writing – review & editing. **Karin De Ridder:** Formal analysis, Conceptualization, Writing – original draft, Writing – review & editing.

### Declaration of Competing Interest

The authors declare that they have no conflicts of interest.

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