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Demographic and health characteristics of 3,4-methylenedioxymethamphetamine users (MDMA, ecstasy)

Gniewko Więckiewicz[1], Dariusz Danel[2], Magdalena Piegza[1], Piotr Gorczyca[1], Robert Pudlo[1]

[1]Department of Psychiatry, Faculty of Medical Sciences in Zabrze, Medical University of Silesia in Katowice

[2]Ludwik Hirszfeld Institute of Immunology and Experimental Therapy, Polish Academy of Sciences

Summary

Aim. MDMA is one of the most commonly used drugs in the world. Clinical studies are currently being conducted around the world on the use of this substance in the treatment of PTSD and alcoholism. However, little demographic information is available on users who use the substance for non-medical purposes. The aim of the study was to determine basic demographic and health characteristics with validated tools.

Method. The authors prepared an original questionnaire on the demography of MDMA users and combined it with *the General Health Questionnaire-28* (GHQ-28) and *the Hospital Anxiety and Depression Scale* (HADS). The survey was sent to Polish MDMA users via the Internet.

Results. 304 responses were received from people over 18 years of age. MDMA is widespread among young adults, in many different places of residence and regardless of gender. The users take MDMA in both pill and crystal form and very rarely test drugs bought from a dealer. Most users feel that MDMA has had a good impact on their lives.

Conclusions. MDMA is rarely used as the only psychoactive substance. MDMA users rate their health higher than people using other psychoactive substances.

Key wards: HDS, MDMA, GHQ-28

Introduction

3,4-methylenedioxymethamphetamine (MDMA, ecstasy) is a psychoactive substance belonging to the group of phenylethylamines known for over a hundred years. Synthesized in Merck laboratories in 1912, it is still present at social events and in

music clubs [1]. About an hour after taking oral MDMA, most often in the form of tablets or crystals of 3,4-methylenedioxymethamphetamine salt, after penetrating the blood-brain barrier, this substance strongly stimulates the serotonin receptor, causing an increase in the level of empathy, a sense of unity with people and an increase in sensations with sounds and lights [2]. MDMA overdose is dangerous to health and life, as it may result in hyperthermia, serotonin syndrome, stroke or sudden cardiac arrest [3]. Nevertheless, this substance is considered to be one of the safest of the group of 'classic drugs' present on the 'black market' before the era of universal access to new psychoactive substances. Nutt et al. [4] indicate that in the ranking of the danger posed by the 20 most popular stimulants used by people, MDMA is in the seventeenth place, and the more dangerous are, among others, alcohol, tobacco, amphetamine and marijuana. Another group of scientists suggests that there is a safe dose of MDMA for humans, ranging from 80 to 100 mg [2].

Currently, research is conducted around the world on the use of MDMA for therapeutic purposes in diseases such as post-traumatic stress disorder (PTSD) or alcoholism. Phase 3 clinical trials are underway in the United States, Canada and Israel on the use of MDMA in PTSD. In 2017, these studies received the status of a breakthrough therapy according to the US Food and Drug Administration [5, 6]. In 2019, MDMA was found safe enough to begin research into its use in the treatment of alcoholism [7]. In June 2020, a clinical trial was launched to assess the safety and effects of MDMA-assisted psychotherapy in five European countries: the Czech Republic, the Netherlands, Norway, Great Britain and Portugal [8].

It is natural for psychiatrists who deal with patients who develop mental or behavioral disorders after MDMA use to doubt the overall safety of its use as a medicine. It should be remembered that the use of ecstasy for therapeutic purposes under the care of medical professionals is different from the use of substances for recreational purposes, and at the same time, there is no research in the literature that would comprehensively describe the demographic and health characteristics of ecstasy users based on scientific reports.

In view of the above, the authors of the article decided to reach people who take the substance in order to explore the issue, because the need for research is urgent – every day on internet forums for users of psychoactive substances (e.g., hyperreal.info) new posts appear from new users with questions and descriptions of experiences after taking MDMA.

Material and methods

Procedure

Reaching people who use illegal psychoactive substances, who are not patients of the Addiction Treatment Clinic at the same time, is difficult due to the penalization

of possession of psychotropic substances from the I-P group specified in the Act on Counteracting Drug Addiction, which includes MDMA. A scientifically proven method of collecting data on this group of people is an internet questionnaire that provides a sense of anonymity [9, 10].

The authors decided to use the Google Forms platform, which enables the creation of easy-to-use questionnaires with the possibility of generating files for statistical calculations and which has already been successfully used in psychiatric research in Poland [9]. The Google Forms platform does not allow users to collect information such as geolocation or IP number. Google's privacy policy precisely defines the manner and scope of processing the data of website visitors (the so-called cookies).

This study was exploratory in nature, it was conducted in accordance with the recommendations of Good Clinical Practice and the Helsinki Declaration. The Bioethics Committee decided that the study did not require its consent (decision of the Bioethics Committee of the Medical University of Silesia in Katowice, number KNW/0022/KB/283/18).

Survey

The survey contained three questionnaires.

(1) Original questionnaire on MDMA use, containing basic sociodemographic questions (gender, sexual orientation, relationship status, education, employment, earnings, size of the place of residence, and question about other drugs) and detailed questions about MDMA use, i.e., age of first contact, form used substance (tablets or crystal), testing the purchased psychoactive substance with colorimetric reagents (e.g., Marquis' reagent), circumstances of MDMA application (doses taken, frequency, with whom, where) and a question about the subjective assessment of the impact of MDMA on your life with the possibility of writing a few sentences for authors.

(2) David Goldberg's *General Health Questionnaire* (GHQ), which is a standalone screening test for the early detection of mental disorders. There are several subtypes of the GHQ with a varying number of questions. The authors chose the GHQ-28, consisting of 28 questions divided into 4 subscales, on the basis of which information can be obtained about the general state of mental health, somatic symptoms (subscale A), anxiety and insomnia (subscale B), social functioning disorders (subscale C), and depression (subscale D) [11]. According to the counting method recommended by the author of the questionnaire, the respondent may obtain 28 points, and persons with 6 or more points are identified as potentially ill [12].

(3) *Hospital Anxiety and Depression Scale* (HADS), which is one of the most frequently chosen screening tests for screening for symptoms of depression

and anxiety. The HADS consists of two subscales, denoted by the letters A (for Anxiety) and D (for Depression). Each subscale contains 7 questions, one can score 42 points and a potential case is considered to be a person with a score equal to or greater than 8 [13].

The survey was distributed to a newsgroup for MDMA users on Facebook. From October 18, 2018 to November 3, 2018, 350 responses were collected, of which 46 questionnaires from minors were rejected (due to the lack of consent of the legal guardian to participate in the study).

Statistics

The analyzes were carried out in STATISTICA version 13.3. The assumption was that the experiment was to be balanced, so the size of the reference group was adjusted to the size of the group taking MDMA. The criterion of qualifying to the comparison group was determined as the smallest time stamp assigned by the survey system at the time the respondent started filling in the survey. Due to the lack of normality of the data distributions in the analyzed variables and the failure to meet the parametric assumptions of the statistical analysis methods, non-parametric methods were used for data analysis. Comparisons between the two groups were performed with the Mann-Whitney test. Due to the relatively large size of the compared groups, the test procedure was based on the Z test statistic, and for a better approximation of the normal distribution by the test statistic, a continuity correction was applied. In the case of comparisons involving more than two groups, the analysis was performed using the Kruskal-Wallis test. Both tests examine the statistical significance of differences between the medians in the compared groups. Additionally, for the comparisons made, the effect size of Cohen's *d* was calculated. The effect size can be assessed personally, $d = 0.2$ should be considered a 'small' effect size, 0.5 is 'medium' effect size and 0.8 is 'large' effect size. This means that if the means of the two groups do not differ by 0.2 standard deviation or more, the difference is small [14]. When the general Kruskal-Wallis test indicated a statistically significant difference between the studied groups, detailed *post-hoc* intergroup comparisons were made using the Dunn test. The research on the relationships between individual continuous variables was carried out using Spearman's rank correlation coefficients. As statistical analyzes were carried out taking into account the gender of the respondents, the analysis excluded one person declaring a non-binary gender. The level of statistical significance was set at $\alpha = 0.05$.

Results

Sample characteristics

In the group taking MDMA (n = 304), there were more men (53.95%) than women, the mean age of the respondents was 22.3 years, 61.51% of them lived in a large city (over 200,000 inhabitants), the vast majority had secondary education (60.86%) and was heterosexual (77.30%), slightly more than half remained in an informal relationship (56.25%). The largest professional group were students (35.53%). In the comparative group (n = 304), there were more women (62.83%) than men, the mean age of the respondents was 26.86 years, 57.24% of them lived in a large city (over 200,000 inhabitants), the vast majority had higher education or equivalent (54.27%) and was heterosexual (85.86%), less than half of them were in an informal relationship (48.36%). The largest professional group were full-time employees (49.34%). The details about sample characteristics are presented in Table 1.

Table 1.**Demographic characteristics of individuals taking MDMA and the comparative group**

Variable		Number	Percent
Group taking MDMA			
Mean age		22.31	-
Sex	Male	164	53.95
	Female	139	45.72
	Non-binary	1	0.33
Place of residence	Large city (over 200,000 inhabitants)	187	61.51
	Medium-sized city (100,000–200,000 inhabitants)	41	13.49
	Small city (10,000–100,000 inhabitants)	49	16.12
	Village or town (less than 10,000 inhabitants)	27	8.88
Education	Primary	2	0.66
	Vocational	9	2.96
	Junior high school	36	11.84
	High school	185	60.86
	Bachelor's degree	48	15.79
	Master's degree or equivalent	24	7.89
Sexual orientation	Heterosexual	235	77.30
	Homosexual	7	2.30
	Bisexual	59	19.41
	Other	3	0.99

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Relationship status	Single	121	41.78
	Informal relationship	171	56.25
	Married	6	1.97
Professional status	Pupil	55	18.09
	Student	108	35.53
	Entrepreneur	10	3.29
	Full-time employee	96	31.58
	Freelance	15	4.93
	Casual worker	11	3.62
	Unemployed	9	2.96
Income	None	66	21.71
	Less than 1000 PLN	51	16.78
	1,000–2,000 PLN	44	14.47
	2,000–3,000 PLN	49	16.12
	3,000–4,000 PLN	42	13.82
	4,000–5,000 PLN	25	8.22
	Over 5,000 PLN	27	8.88
Comparative group			
Mean age	26.86	-	
Sex	Male	113	37.17
	Female	191	62.83
	Non-binary	0	0
Place of residence	Large city (over 200,000 inhabitants)	174	57.24
	Medium-sized city (100,000–200,000 inhabitants)	47	15.46
	Small city (10,000–100,000 inhabitants)	48	15.79
	Village or town (less than 10,000 inhabitants)	35	11.51
Education	Primary	3	0.99
	Vocational	3	0.99
	Junior high school	8	2.63
	High school	90	29.61
	Bachelor's degree	35	11.51
	Master's degree or equivalent	165	54.27

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Sexual orientation	Heterosexual	261	85.86
	Homosexual	15	4.93
	Bisexual	25	8.22
	Other	3	0.99
Relationship status	Single	93	30.60
	Informal relationship	149	49.01
	Married	62	20.39
Professional status	Pupil	17	5.59
	Student	150	49.34
	Entrepreneur	9	2.96
	Full-time employee	77	25.33
	Freelance	28	9.22
	Casual worker	15	4.93
	Unemployed	8	2.63
Income	None	52	17.10
	Less than 1000 PLN	22	7.24
	1,000–2,000 PLN	20	6.58
	2,000–3,000 PLN	60	19.74
	3,000–4,000 PLN	34	11.18
	4,000–5,000 PLN	27	8.88
	Over 5,000 PLN	89	29.28

Taking MDMA

85 respondents (27.96%) had their first exposure to MDMA before reaching the age of majority, and 158 (51.97%) respondents were aged 18–21. 57.89% of respondents never test purchased MDMA with colorimetric reagents, and 27.71% do so occasionally. The largest group of respondents are those taking the doses of 100 to 200 mg (29.28%). 54.93% of respondents use MDMA twice in one session. In terms of frequency of use, the largest group are people using MDMA once every 1–2 months (43.42%). 73.68% of respondents most often use MDMA in a group of friends and 47.04% of respondents most often use it at home or apartment. Detailed results of the MDMA intake survey are presented in Table 2.

Table 2. **Results of the MDMA intake survey**

Variable		Number	Percent
Age of first exposure to MDMA	13–15	9	2.96
	16–18	123	40.46
	19–21	111	36.51
	22–26	48	15.79
	27–43	13	4.28
The most frequently consumed form of substance	Pills	219	72.04
	Crystal	82	26.97
	Both	3	0.99
Do you test MDMA with colorimetric reagents?	No. never	176	57.89
	Occasionally	66	21.71
	Yes, sometimes	39	12.83
	Yes, always	23	7.57
What doses do you take most often?	<100 mg	13	4.28
	100–200 mg	89	29.28
	200–300 mg	71	23.35
	300–400 mg	23	7.57
	>400 mg	15	4.93
	I don't know. I use pills	75	24.67
	I don't know. I 'eyeball' the dose	18	5.92
How many times do you take MDMA in one session?	Once	79	25.99
	Twice	167	54.93
	Thrice	35	11.51
	More than thrice	23	7.57
How often do you take MDMA?	More than once a month	72	23.68
	Once every 1–2 months	132	43.42
	Once every 3–6 months	78	25.66
	Once every 7–12 months	15	4.93
	Less often than once a year	7	2.31

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Where do you use it the most often?	Home	143	47.04
	Parties	139	45.72
	Outside	10	3.29
	Music festival	8	2.63
	Bars	4	1.32
With whom do you use it the most often?	With friends	224	73.68
	With partner	72	23.68
	Alone	7	2.31
	With family	1	0.33
How do you feel MDMA affected your life?	Very good	62	20.39
	Good	84	27.63
	Rather good	67	22.04
	It didn't	62	20.39
	Rather bad	23	7.57
	Bad	2	0.66
	Very bad	4	1.32

Use of substances other than MDMA

Three people took no substance other than MDMA (0.9%). 58 people (19.1%) used 1 to 3 other drugs, 145 people (47.7%) used 4 to 6 other drugs, and 96 respondents (31.6%) used more than 7 different psychoactive drugs. The highest number of substances, thirteen different psychoactive substances, was used by 2 people (0.7%).

Among the most commonly used other psychoactive substances were: alcohol (83.7%), marijuana (77.1%), caffeine (75.4%), nicotine (74.3%), amphetamine (53.4%), LSD (52.3%), benzodiazepines (30.3%), hallucinogenic mushrooms (24.6%), opiates (21.7%), cocaine (19.1%), ketamine (10%), methamphetamine (8.3%), GHB or GBL (5.4%), and synthetic cathinones (3.9%).

GHQ-28 and HADS

I. Comparison with the comparative group

In the case of men, the analysis showed that the GHQ-28 scores were statistically significantly higher in the comparison group compared to the MDMA group for the total GHQ score and for the B and D subscales. In the case of women, statistically significantly higher scores were observed for the total GHQ score and the A and D subscales. Other differences, both for women and men, were not statistically significant.

The HADS *Anxiety* and HADS *Depression* results did not differ statistically significantly between the study group and the control group for both women and men. Detailed results are presented in Tables 3 and 4.

Table 3. **GHQ-28 results**

Men													
	MDMA users (n = 164)					Comparative group (n = 113)					Group comparison (Me): Mann-Whitney test		Effect size
GHQ	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
Total	4.88	2.0	0	22	5.750	7.17	5.0	0	23	6.317	-3.51	<0.001	0.431
A	1.37	1.0	0	7	1.676	1.58	1.0	0	7	1.673	-1.24	0.22	0.149
B	1.21	0.0	0	7	1.718	1.77	1.0	0	7	1.946	-2.61	0.009	0.318
C	0.99	0.0	0	7	1.652	1.30	0.0	0	7	1.927	-1.49	0.14	0.18
D	1.31	0.0	0	7	2.041	2.52	2.0	0	7	2.529	-4.64	<0.0001	0.581
Women													
	MDMA users (n = 139)					Comparative group (n = 191)					Group comparison (Me): Mann-Whitney test		Effect size
GHQ	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
Total	7.15	5.0	0	27	7.064	9.31	8.0	0	28	7.640	-2.71	0.007	0.302
A	1.66	1.0	0	7	1.852	2.50	2.0	0	7	2.110	-3.57	<0.001	0.401
B	2.14	2.0	0	7	2.103	2.45	2.0	0	7	2.275	-1.06	0.29	0.117
C	1.47	0.0	0	7	2.058	1.89	1.0	0	7	2.372	-1.35	0.18	0.149
D	1.88	1.0	0	7	2.466	2.47	1.0	0	7	2.593	-2.64	0.008	0.294

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

Table 4. **HADS results**

Men													
	MDMA users (n = 164)					Comparative group (n = 113)					Group comparison (Me): Mann-Whitney test		Effect size
HADS	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
Anxiety	6.15	5.0	0	19	4.328	6.74	6.0	0	18	4.144	-1.24	0.21	0.149
Depression	4.02	3.0	0	16	3.645	4.96	3.0	0	15	4.067	-1.83	0.07	0.221
Women													

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	MDMA users (n = 139)					Comparative group (n = 191)					Group comparison (Me): Mann-Whitney test		Effect size
HADS	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
Anxiety	9.14	9.0	1	21	4.731	8.84	8.0	1	20	4.347	0.34	0.73	0.037
Depression	4.57	3.0	0	15	3.730	4.65	4.0	0	19	3.932	0.03	0.98	0.003

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

Both men and women in the MDMA group used more psychoactive substances (apart from MDMA) than the control group (Table 5).

Table 5. **Number of psychoactive substances used in addition to MDMA**

Men													
	MDMA users (n = 164)					Comparative group (n = 113)					Group comparison (Me): Mann-Whitney test		Effect size
	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
Other psychoactive substances	5.45	5.0	0	13	2.488	2.09	2.0	0	7	1.497	10.86	<0.0001	1.722
Women													
	MDMA users (n = 139)					Comparative group (n = 191)					Group comparison (Me): Mann-Whitney test		Effect size
	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
Other psychoactive substances	5.42	5.0	0	11	2.140	1.72	2.0	0	5	1.148	13.76	<0.0001	2.939

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

In the group of women using MDMA ($n = 139$), the number of other psychoactive substances used was significantly positively correlated with the HADS *Anxiety* results ($rs\ n_{=139} = 0.21$; $p = 0.014$), HADS *Depression* results ($rs\ n_{=139} = 0.29$; $p = 0.001$), overall GHQ score ($rs\ n_{=139} = 0.18$; $p = 0.032$), and the GHQ B subscale ($rs\ n_{=139} = 0.17$; $p = 0.04$). No statistically significant relationship was observed for the GHQ A, C and D subscales (all correlations: $|rs\ n_{=139}| \leq 0.16$; $p > 0.052$). In men taking MDMA ($n = 164$), no statistically significant correlations were observed between the number of

taken additional psychoactive substances (apart from MDMA) and individual HADS and GHQ scores (all correlations: | $rs\ n_{=164}$ | <0.14; p >0 08).

In the comparative group of women (n = 191), the number of used psychoactive substances (apart from MDMA) was significantly positively correlated with the GHQ D results ($rs\ n_{=191}$ = 0.18; p = 0.01). The other correlations were statistically insignificant (all correlations: $|rs\ n_{=191}| \leq 0.13$; p >0.07). In the comparative group of men (n = 113), no statistically significant correlations were observed between the number of other psychoactive substances taken and individual HADS and GHQ scores (all correlations: $|rs\ n_{=113}|$ <0.12; p >0.20).

II. Demographic analysis

Among people using MDMA, 69 individuals (22.70%) declared having a non-heterosexual orientation. Both in women and in men, no statistically significant differences were found between the individual HADS and GHQ scores observed among heterosexual and non-heterosexual people.

Table 6. **GHQ and HADS results in relation to gender and sexual orientation of MDMA users**

		Men												
		Heterosexual (n = 147)					Other than heterosexual (n = 17)					Group comparison (Me): Mann-Whitney test		Effect size
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
HADS	Anxiety	6.14	5.0	0	19	4.388	6.29	6.0	0	14.0	3.885	-0.41	0.68	0.064
	Depression	3.91	3.0	0	16	3.515	5.00	3.0	0	15.0	4.637	-0.61	0.54	0.095
GHQ	Total	4.68	2.0	0	22	5.612	6.59	4.0	0	18.0	6.783	-1.00	0.32	0.157
	A	1.35	1.0	0	7	1.683	1.47	1.0	0	6.0	1.663	-0.52	0.60	0.081
	B	1.17	0.0	0	7	1.702	1.53	0.0	0	5.0	1.875	-0.59	0.55	0.092
	C	0.93	0.0	0	7	1.560	1.53	0.0	0	7.0	2.294	-0.76	0.45	0.119
	D	1.22	0.0	0	7	2.006	2.06	1.0	0	6.0	2.249	-1.68	0.09	0.265
		Women												
		Heterosexual (n = 88)					Other than heterosexual (n = 51)					Group comparison (Me): Mann-Whitney test		Effect size
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
HADS	Anxiety	8.89	9.0	1	20	4.356	9.57	8.0	1	21	5.334	-0.50	0.62	0.085
	Depression	4.34	3.0	0	13	3.328	4.96	4.0	0	15	4.345	-0.33	0.74	0.056

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GHQ	Total	6.39	4.0	0	25	6.455	8.47	7.0	0	27	7.900	-1.29	0.20	0.22
	A	1.51	1.0	0	7	1.742	1.92	1.0	0	7	2.018	-1.12	0.26	0.191
	B	1.93	1.0	0	7	1.940	2.49	2.0	0	7	2.336	-1.15	0.25	0.196
	C	1.27	0.0	0	7	1.898	1.82	1.0	0	7	2.287	-1.49	0.14	0.255
	D	1.67	0.0	0	7	2.396	2.24	1.0	0	7	2.566	-1.42	0.16	0.243

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

There were no statistically significant differences in individual HADS and GHQ scores between men declaring higher education and other than higher education. On the other hand, between the analogously defined groups of women, statistically significant differences were observed for the HADS Anxiety, GHQ general score, GHQ A, GHQ B, and GHQ C scales, where the results were higher in the education group other than higher. The differences in the GHQ D scale were not statistically significant.

Table 7. **GHQ and HADS results in relation to gender and education of MMA users**

	Men												
		Higher education (n = 40)					Education other than higher (n = 124)					Group comparison (Me): Mann-Whitney test		Effect size
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
HADS	Anxiety	5.72	4.0	0	19	4.484	6.29	6.0	0	17	4.286	0.98	0.33	0.154
	Depression	3.30	2.0	0	14	3.458	4.26	3.0	0	16	3.687	1.68	0.09	0.256
GHQ	Total	4.40	2.0	0	22	6.259	5.03	2.0	0	21	5.595	1.39	0.16	0.218
	A	1.13	0.0	0	5	1.522	1.44	1.0	0	7	1.722	1.09	0.27	0.171
	B	1.15	0.0	0	7	1.994	1.23	1.0	0	7	1.627	1.30	0.19	0.204
	C	1.00	0.0	0	6	1.601	0.99	0.0	0	7	1.675	-0.51	0.61	0.08
	D	1.13	0.0	0	7	1.937	1.37	0.0	0	7	2.078	0.71	0.48	0.111
	Women													
		Higher education (n = 32)					Education other than higher (n = 107)					Group comparison (Me): Mann-Whitney test		Effect size
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
HADS	Anxiety	7.69	7.0	2	20	4.028	9.57	9.0	1	21	4.855	2.02	0.04	0.348
	Depression	3.63	2.5	0	13	3.180	4.85	4.0	0	15	3.848	1.55	0.12	0.265

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GHQ	Total	4.47	2.5	0	18	4.600	7.95	6.0	0	27	7.480	2.10	0.04	0.362
	A	0.91	1.0	0	3	0.963	1.89	1.0	0	7	1.992	2.18	0.03	0.376
	B	1.44	1.0	0	6	1.645	2.35	2.0	0	7	2.185	2.02	0.04	0.348
	C	0.63	0.0	0	4	1.040	1.73	1.0	0	7	2.217	2.30	0.02	0.398
	D	1.50	0.0	0	7	2.229	1.99	1.0	0	7	2.531	1.09	0.27	0.186

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

With regard to the place of residence of people using MDMA, both women and men showed statistically significant differences in the results of the GHQ C subscale. The HADS results for anxiety and depression and for GHQ, the general result as well as the A, B and D subscales, did not differ statistically significantly between the place of residence declared by both sexes.

Table 8. **GHQ and HADS results in relation to gender and place of residence of MDMA users**

	Men													
		Village or small city (n = 44)					Medium-sized or large city (n = 120)					Group comparison (Me): Mann-Whitney test		Effect size
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
HADS	Anxiety	6.16	5.5	0	15	4.393	6.15	5.0	0	19	4.322	-0.09	0.93	0.014
	Depression	4.07	3.0	0	12	3.372	4.01	3.0	0	16	3.754	-0.20	0.84	0.031
GHQ	Total	4.73	3.5	0	18	4.905	4.93	2.0	0	22	6.048	-0.46	0.64	0.072
	A	1.18	1.0	0	6	1.451	1.43	1.0	0	7	1.752	0.45	0.66	0.07
	B	1.11	0.0	0	6	1.528	1.24	0.0	0	7	1.787	0.05	0.96	0.008
	C	1.23	1.0	0	7	1.655	0.91	0.0	0	7	1.650	-2.00	0.045	0.316
	D	1.20	0.0	0	7	2.041	1.35	0.0	0	7	2.048	0.15	0.88	0.023
	Women													
		Village or small city (n = 32)					Medium sized or large city (n = 107)					Group comparison (Me): Mann-Whitney test		Effect size
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	Z	p	d
HADS	Anxiety	9.81	8.5	1.0	20	5.515	8.93	9.0	1	21	4.479	-0.62	0.54	0.105
	Depression	5.56	5.5	0.0	15	4.219	4.27	3.0	0	15	3.538	-1.44	0.15	0.246

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GHQ	Total	8.34	6.0	0.0	26	7.486	6.79	4.0	0	27	6.929	-1.11	0.27	0.189
	A	1.63	1.0	0.0	6	1.809	1.67	1.0	0	7	1.872	0.10	0.92	0.017
	B	2.16	1.5	0.0	7	2.343	2.13	2.0	0	7	2.038	0.28	0.78	0.048
	C	2.13	1.0	0.0	7	2.297	1.28	0.0	0	7	1.951	-2.12	0.03	0.366
	D	2.44	2.0	0.0	7	2.639	1.71	0.0	0	7	2.399	-1.76	0.08	0.302

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

III. Schemes for using MDMA

Individual HADS and GHQ scores did not differ significantly (all $H(2, n = 164) < 4.73$; $p > 0.09$; $d < 0.263$) between the 3 groups of men characterized by different frequencies of MDMA use, i.e., once a quarter, once every 1–2 months, more than once a month. For the analogously defined frequency of MDMA use among women, no statistically significant differences were observed for the HADS *Anxiety*, GHQ general result, GHQ A and GHQ D (all $H(2, n = 139) < 5.85$; $p > 0.05$; $d < 0.341$). However, statistically significant differences were found in the HADS *Depression* results ($H(2, n = 139) = 8.37$; $p = 0.02$; $d = 0.443$), GHQ B ($H(2, n = 139) = 8.25$; $p = 0.02$; $d = 0.439$), GHQ C (H(2, $n = 139$) = 9.82; $p = 0.007$; $d = 0.494$). *Post-hoc* analysis with Dunn's test showed that statistically significant differences exist only between the values observed in the group of people who take MDMA once a quarter or those who take MDMA more than once a month (HADS *Depression*: $Z = 2.88$; $p = 0, 01$; GHQ B: $Z = 2.79$; $p = 0.02$; GHQ C: $Z = 2.84$; $p = 0.01$); results for intergroup comparisons in other subscales: $Z < 2.04$; $p > 0.12$). In each statistically significant comparison, the results were higher in the group of women taking MDMA more than once a month. Detailed descriptive statistics are presented in Table 9.

Table 9. **Descriptive statistics for the GHQ and HADS in relation to gender and frequency of MDMA use**

		Men														
		Once every 3 months or less frequently (n = 54)					Once every 1–2 months (n = 76)					More frequently than once a month (n = 34)				
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD
HADS	Anxiety	6.93	6.0	0	19	4.750	5.37	5.0	0	15	3.680	6.68	5.0	0	16	4.778
	Depression	3.87	3.0	0	16	3.608	3.74	3.0	0	15	3.481	4.91	3.5	0	14	4.018
GHQ	Total	5.09	3.0	0	18	5.152	4.39	2.0	0	22	5.868	5.62	2.0	0	19	6.424
	A	1.76	1.0	0	6	1.822	1.13	0.0	0	7	1.569	1.26	1.0	0	6	1.601
	B	1.26	1.0	0	7	1.604	1.08	0.0	0	6	1.719	1.41	0.0	0	7	1.909
	C	0.76	0.0	0	5	1.243	0.93	0.0	0	7	1.676	1.50	0.0	0	7	2.063
	D	1.31	0.0	0	6	1.931	1.25	0.0	0	7	2.092	1.44	0.0	0	7	2.149

table continued on the next page

		Women														
		Once every 3 months or less frequently (n = 45)					Once every 1-2 months (n = 56)					More frequently than once a month (n = 38)				
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD
HADS	Anxiety	8.40	8.0	1	18	4.423	8.96	8.5	2	20	4.272	10.26	9.5	1	21	5.574
	Depression	3.62	2.0	0	14	3.544	4.39	4.0	0	13	3.257	5.95	4.5	0	15	4.255
GHQ	Total	5.56	4.0	0	25	6.066	6.63	5.0	0	25	6.358	9.82	9.5	0	27	8.453
	A	1.42	1.0	0	6	1.602	1.52	1.0	0	7	1.716	2.16	1.0	0	7	2.236
	B	1.62	1.0	0	7	1.946	2.02	1.5	0	7	1.968	2.92	3.0	0	7	2.294
	C	1.02	0.0	0	7	1.877	1.27	0.0	0	6	1.773	2.32	1.5	0	7	2.428
	D	1.49	1.0	0	7	2.041	1.82	0.5	0	7	2.398	2.42	1.0	0	7	2.947

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

The analysis of the HADS and GHQ results observed among men grouped into 3 categories defined by the declared MDMA doses taken (i.e., up to 200 mg, over 200 mg, "I do not know") showed no statistically significant differences between groups in the case of the HADS *Anxiety*, GHQ general result, GHQ A, B and C (for all comparisons: $H(2, n = 164) < 3.57$; $p > 0.16$; $d < 0.198$). General comparison of the HADS *Depression* values ($H(2, n = 164) = 6.45$; $p = 0.04$; $d = 0.337$) and GHQ D ($H(2, n = 164) = 6.93$; $p = 0.03$; $d = 0.355$) showed a statistically significant difference between men classified in terms of the declared dose levels. However, detailed *post-hoc* comparisons with Dunn's test did not reveal any intergroup difference that was statistically significant (for all comparisons: $Z < 2.27$; $p > 0.06$). A similar general analysis for women showed no statistically significant differences for the HADS *Anxiety*, HADS *Depression*, GHQ general score, GHQ B, C and D (for all comparisons: $H(2, n = 139) < 4.53$; $p > 0.10$; $d < 0.275$). In the case of GHQ A, the general test showed statistically significant differences between the groups ($H(2, n = 139) = 6.87$; $p = 0.03$; $d = 0.385$). However, as in the case of men, detailed *post-hoc* intergroup comparisons did not confirm the statistical significance of the observed differentiation of the GHQ A results (for all comparisons: $Z < 2.34$; $p > 0.05$). Detailed descriptive statistics are presented in Table 10.

Table 10. **Descriptive statistics for the GHQ and HADS in relation to gender and the dose of MDMA**

		Men														
		I don't know (n = 44)					Up to 200 mg (n = 52)					Over 200 mg (n = 68)				
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD
HADS	Anxiety	7.02	7.0	0	15	4.332	5.69	5.0	0	19	4.408	5.94	5.0	0	17	4.246
	Depression	4.27	4.0	0	12	3.252	3.00	2.0	0	14	3.074	4.65	3.0	0	16	4.135

table continued on the next page

GHQ	Total	5.73	3.5	0	22	6.203	3.63	2.0	0	20	4.891	5.28	2.0	0	21	5.975
	A	1.48	1.0	0	6	1.798	1.13	1.0	0	7	1.534	1.47	1.0	0	6	1.706
	B	1.27	0.5	0	6	1.633	0.98	0.0	0	7	1.766	1.34	1.0	0	7	1.742
	C	1.25	0.0	0	7	1.767	0.77	0.0	0	5	1.366	1.00	0.0	0	7	1.770
	D	1.73	0.5	0	7	2.336	0.75	0.0	0	7	1.643	1.47	0.0	0	7	2.048
	Women															
		I don't know (n = 48)					Up to 200 mg (n = 50)					Over 200 mg (n = 41)				
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD
HADS	Anxiety	8.38	8.0	1	18	3.977	9.20	9.0	1	20	4.490	9.95	10.0	1	21	5.705
	Depression	4.42	4.0	0	14	3.463	3.96	3.0	0	15	3.653	5.49	6.0	0	15	4.026
GHQ	Total	6.33	5.0	0	25	6.114	6.16	3.0	0	25	6.867	9.32	7.0	0	27	7.976
	A	1.44	1.0	0	7	1.700	1.28	1.0	0	6	1.499	2.39	2.0	0	7	2.212
	B	1.90	2.0	0	7	1.836	1.94	1.0	0	7	2.014	2.66	3.0	0	7	2.435
	C	1.33	0.0	0	6	1.849	1.22	0.0	0	7	1.930	1.95	1.0	0	7	2.387
	D	1.67	0.0	0	7	2.337	1.72	0.0	0	7	2.450	2.32	1.0	0	7	2.631

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

The comparison of the individual HADS and GHQ results in the group of men taking MDMA who used a single dose or more than one dose during one session (the so-called top-ups) showed that the differences are statistically significant only in the case of the HADS *Depression* (Mann-Whitney test: $Z = 2.13$; $p = 0.034$; $d = 0.337$; slightly higher results were observed in the group of men using "top-ups"). Intergroup differences for the HADS *Anxiety* and individual GHQ scores were not statistically significant (for all comparisons using the Mann-Whitney test: $|Z| < 0.84$; $p > 0.40$; $d < 0.131$). A similar analysis conducted for women who did not use "top-ups" and those who declared such practices, showed no statistically significant differences (for all comparisons using the Mann-Whitney test $|Z| < 1.53$; $p > 0.12$; $d < 0.262$). Descriptive statistics are presented in Table 11.

Table 11. **Descriptive statistics for the GHQ and HADS in relation to gender and the use of "top-ups" during one session**

		Men									
		One dose each session (n = 38)					More than one dose each session (n = 126)				
		M	Me	Min.	Max.	SD	M	Me	Min.	Max.	SD
HADS	Anxiety	6.32	5.5	0	17	4.449	6.10	5.0	0	19	4.308
	Depression	2.68	2.0	0	9	2.055	4.43	3.0	0	16	3.920

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GHQ	Total	4.05	2.0	0	17	4.915	5.13	2.0	0	22	5.975
	A	1.21	0.5	0	7	1.663	1.41	1.0	0	6	1.684
	B	0.97	0.0	0	5	1.385	1.28	0.0	0	7	1.805
	C	0.66	0.0	0	7	1.279	1.10	0.0	0	7	1.741
	D	1.21	0.0	0	7	2.145	1.34	0.0	0	7	2.017
	Women										
		One dose each session (n = 41)					More thanone dose eachsession (n = 98)				
		M	Me	Min	Max	SD	M	Me	Min	Max	SD
HADS	Anxiety	9.76	9.0	4	21	4.409	8.88	8.0	1.0	20	4.857
	Depression	4.90	4.0	0	15	3.477	4.43	3.0	0.0	15	3.840
GHQ	Total	7.00	5.0	0	27	7.039	7.21	4.5	0.0	26	7.109
	A	1.59	1.0	0	7	1.774	1.69	1.0	0.0	7	1.891
	B	1.90	1.0	0	7	1.934	2.23	2.0	0.0	7	2.172
	C	1.68	1.0	0	7	2.018	1.39	0.0	0.0	7	2.079
	D	1.83	1.0	0	7	2.386	1.90	1.0	0.0	7	2.510

M – arithmetic means; Me – median; Min., Max. – minimum and maximum values; SD – standard deviation

Age of first exposure to MDMA did not statistically significantly correlate with individual HADS and GHQ scores in men (for all correlations $|rs\ n_{=164}| < 0.10$; $p > 0.20$). In the case of women, statistically significant negative correlations were observed between the age of the first contact with MDMA and the HADS *Anxiety* ($rs\ n_{=139} = -0.26$; $p = 0.002$), HADS *Depression* ($rs\ n_{=139} = -0.27$; $p = 0.001$), GHQ general score ($rs\ n_{=139} = -0.31$; $p = 0.0002$), GHQ A ($rs\ n_{=139} = -0.28$; $p = 0.001$), GHQ B ($rs\ n_{=139} = -0.26$; $p = 0.002$), GHQ C ($rs\ n_{=139} = -0.32$; $p = 0.0001$). The correlation between the age of first exposure to MDMA and the GHQ D was not statistically significant ($|rs\ n_{=139}| = -0.16$; $p = 0.07$).

Discussion

A psychiatrist in Poland meets MDMA not only while reading the latest scientific reports, but also in his daily practice. According to *the Global Drug Survey 2019*, the largest annual international substance use survey, MDMA is the fourth most used psychoactive drug in the world in 2019 – after alcohol, marijuana and tobacco. The results of the same survey show that 2.5% of Polish MDMA users sought medical help after taking it – the highest result among all countries participating in the survey (global average is 1%) [15]. Drugs with home delivery can be easily purchased in the so-called

Dark Web, Dark Net, that is, websites that are accessible only through a suitable web browser, where ecstasy is the second most popular category and online sellers ship drugs from 70 countries around the world [16]. In the authors' opinion, the above information indicates that information about MDMA users is needed in order to understand the problem and plan appropriate, early help – high doses of MDMA may turn out to be toxic, most of the proposed protocols in clinical trials assume the administration of less than 200 mg in two divided doses, and illegally sold tablets contain up to 330 mg of MDMA, which is a potentially dangerous amount of this substance [17].

Because the study was naturalistic and exploratory, and polytoxicomania was a common phenomenon among respondents, it cannot be assumed that MDMA users perform better than those who do not use MDMA, as these results may be associated with reduced criticism of their own health condition, or other distortions of self-esteem [18]. Conducting personal, long-term observations of MDMA users to verify this result can be difficult in the face of penalizing the possession of psychoactive substances, including MDMA, which may lead users to avoid telling the truth in contact with their physician.

Interpretation of the correlation between age of first MDMA use and depression and health needs to be done carefully. The disclosed distribution of the age of initiation does not allow for drawing unequivocal conclusions, also in terms of differences between the sexes. The early age of first use of the substance is alarming – 85 respondents (27.96%) had used MDMA before the age of eighteen. It is worth recalling that for formal reasons, the authors could not analyze 46 responses from minors, which does not change the fact that 37.43% of all respondents had taken MDMA before reaching the age of majority, therefore reaching primary and secondary schools with appropriate education in drug prevention is crucial.

Sexual minorities are 1.5–2 times more likely to develop anxiety or affective disorders than heterosexuals, 37–50% of the gay and lesbian population have had suicidal thoughts at least once in their lives, and people with gender and non-binary identity disorders are three times more exposed to the use of psychoactive substances than the general population [19, 20]. This information does not result from this article, but it is included in the recommendations on the care of non-heteronormative persons for general practitioners [21]. *The Rainbow Europe 2020* report prepared by ILGA Europe (International Lesbian, Gay, Bisexual, Trans and Intersex Association Europe) shows that Poland has the lowest non-heteronormative acceptance score of all European Union countries [22]. Taking into account the quoted data and the information from the survey that 22.70% of respondents are non-heteronormative people, it is important, in the authors' opinion, to reach the LGBT community with psychological support and drug prevention at the same time.

While MDMA itself seems to be a relatively safe substance in healthy people because scientists have determined the amount of the substance safe for the body at the

level of 80–100 mg [17], the situation in which 57.89% of users never test their MDMA is a significant threat from the point of view of the individual's health because it is conducive to the consumption of another, potentially more dangerous substance, e.g., 4-methoxyamphetamine, a substance that produces effects similar to MDMA, but much cheaper, which makes it one of the most popular admixtures found in MDMA samples, and as a result it is responsible for a large amount of deaths after taking ecstasy [23].

Only three respondents took no psychoactive substance other than MDMA. Polytoxicomania is a common phenomenon among MDMA users, which in the context of the naturalistic nature of the above study is a significant limitation in drawing unequivocal conclusions about the mental health of MDMA users. The amount of substances taken positively correlates with the HADS results and the GHQ general score, which suggests worse mental functioning in people taking many substances. This problem has also been positively correlated in other Polish publications [9].

Study limitations

This article is probably the only, and certainly the most up-to-date, source of demographic and epidemiological knowledge about Polish MDMA users, but it is important to note a few limitations of the survey. The exploratory nature of the presented research implies the possibility of some type of errors, so the obtained results should be treated rather as a basis for constructing verification studies than as final data to be included in textbooks. The most important group of potential errors – i.e., the risk of incorrect or false filling out of the questionnaire – was inevitable because due to the penalization of possession of MDMA, only online contact ensured the respondents anonymity and freedom of expression.

The desire to collect as much material as possible resulted in limiting the exclusion criteria to age – which was a legal necessity. Research samples could not be defined in advance, but the selected statistical tools allow for drawing the presented conclusions.

Despite the aforementioned limitations, the amount of collected data and the lack of comparable studies encourages the authors to present the results of the study.

Conclusions

1. MDMA is rarely used as the only psychoactive substance.
2. At least 27% of MDMA users experienced drug initiation before reaching the age of majority.
3. Significant percentage of people using MDMA are non-heteronormative people.
4. MDMA users rate their health higher than people using other psychoactive substances.

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Address: Gniewko Więckiewicz
Medical University of Silesia in Katowice
Faculty of Medical Sciences in Zabrze
Department of Psychiatry
42-612 Tarnowskie Góry, Pyskowicka Street 49
e-mail: gniewkowieckiewicz@gmail.com