What Do Young Adults Expect from the Recreational Use of Ecstasy (3,4-Methylenedioxymethamphetamine/Molly)? A Latent Class Analysis of a Convenience Sample of Dutch Young Adults

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Abstract

Introduction: This study offers insights into Dutch young people's expected social and personal consequences of ecstasy use. Substance use expectancies are assumed to be an essential component in explaining substance use behaviour and, therefore, the development of effective substance use prevention and treatment strategies. ***Method:*** Dutch young adults with an online interest in drug-related social media posts were targeted with an online survey about their use of alcohol and drugs. This resulted in a convenience sample ($N = 4182$, 73.4% female, $M_{age} = 21.11$), of which 35.5% had used ecstasy at least once in their life and 29.3% had used ecstasy last year. Latent class analyses were used to identify subgroups based on both positive and negative expectancies of ecstasy use. Cross-class differences were examined using multinomial logistic regression. ***Results:*** This study yielded four distinct classes: only negative expectancies (13.6%), high positive and negative expectancies (23.5%), low to moderate positive and negative expectancies (20.6%), and mostly positive expectancies (22.4%). These classes differed significantly in lifetime experience with ecstasy use, intention to use ecstasy, perception of harmfulness and availability, and social norms regarding the use of ecstasy. ***Conclusion:*** Findings show that ecstasy use expectancies can be used to create meaningful classes of users and non-users, and that these classes are different enough to warrant varied prevention approaches. Expectancies young people have regarding the use of ecstasy are associated with various ecstasy use-related variables and should be taken into consideration when developing and implementing preventive interventions.

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Introduction

Ecstasy, the synthetic drug containing MDMA (3,4-methylenedioxymethamphetamine), is a popular party drug among young adults. It is estimated that 4.1% of all adults in the European Union (aged 15–64) have used

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ecstasy at least once in their lifetime. Between 0.2% and 0.7% of the global population (aged 15–64) is estimated to have used ecstasy in the past year. Among young adults, the past year prevalence of ecstasy use is the highest: 2.4% in Europe for the 15–24 age group. In the Netherlands, the prevalence in the 20–24 age group is 12.1%, indicating that in the Netherlands, use of ecstasy is relatively common [1–3]. In Australia and Europe, ecstasy-related deaths have been rising in the past decade [4].

This study aimed to offer insights into expectancies (the expected social and personal consequences of substance use) young people have from the use of ecstasy. It also means to uncover associations between these expectancies and ecstasy use behaviour and other variables that are relevant for prevention and intervention efforts, such as intention to use, perception of harmfulness, availability, and social norms. The study uses a convenience sample of Dutch young adults aged 18–25.

Young adults who use ecstasy report that it makes them feel sociable, sensual, and close to their friends and allows them to keep dancing for hours [5–9]. They expect to feel "loved up," "sociable," and "confident" [10]. Several studies indicate that such positive outcome expectancies were significantly associated with frequency of ecstasy use and were a significant predictor of ecstasy use behaviour [9, 11–14]. One study found several outcome expectancies for ecstasy use that strongly discriminated between users and non-users of ecstasy [9]. Particularly, respondents with a high score on the expectancy of self-insight and a low score on the expectancy of negative effects were most likely to use ecstasy. A study by Smerdon and Francis [12] showed that having outcome expectancies of increased confidence, tension reduction, and overall positive expectancies predicted how frequently a person would use ecstasy.

Most studies that investigate drug use expectancies focus entirely on a sample that has (recent) experience using drugs [5, 15–17]. Less is known about the reasons young adults do not use drugs and the expectancies they might have regarding drug use. Information about ecstasy expectancies could prove to be insightful in the development of effective preventive interventions [18]. For example, knowing that some young adults do not use ecstasy because they expect their friends and family to disapprove could be a reason to use a social norms approach in prevention interventions. Ultimately, this study is meant to offer insights into ecstasy expectancies and their association with the use or non-use of ecstasy in order to improve preventive interventions. Therefore, in designing this study, it was essential to include both non-users and people who use ecstasy.

Expectancies underlying substances are assumed to be an essential component in the development of effective substance use prevention and treatment strategies [9, 19, 20]. It is possible to tailor treatment and preventive intervention efforts to the specific processes that underlie use for different types of users with different expectancies [21, 22]. Therefore, the first aim of this study was to determine patterns of positive and negative expectancies of ecstasy use among young adults in general. The second aim of this study was to investigate associations between these expectancies and several determinants of behaviour that influence motivation according to the Integrated-Change (I-Change) model [23]. The I-Change model is an integrated health behaviour theory that incorporates several theories on behaviour change, such as the Theory of Planned Behaviour [24] and the Health Belief Model [25]. The I-Change model postulates that three stages or phases lead to behaviour: an awareness phase precedes the motivation phase, which in turn impacts an action phase. Risk perception and availability are, among other factors, part of the awareness phase. The motivational phase (e.g., attitude, social influence, intention) describes attitude as the perceived advantages and disadvantages (expectancies) of the behaviour. Social influence in this model consists of the perception of others carrying out this type of behaviour (descriptive norms) and the norms that people have with respect to these behaviours (injunctive norms) [26]. The action phase includes planning and execution of intentions and existence of skills and barriers. All phases are influenced by personal factors and informational factors.

This study offers insights into the interaction between various determinants of ecstasy use behaviour that are present in the I-Change model. A better understanding of ecstasy expectancies and related factors can inform harm reduction interventions by providing insights into how the drug is being used and in what contexts, so that risk reduction efforts can be tailored accordingly [27, 28].

Method

Study Design
We used data from an online questionnaire. The questionnaire was launched on February 19th, 2019 and closed on June 13th, 2019. Respondents were recruited through a social media campaign on platforms like Facebook and Instagram. Text and photos used in the campaign posts were adapted to attract a variation of young people aged 18–25, for example, sports lovers, students working on a thesis, and people getting ready to go to a party. Every post expressed the researchers' interest in reasons for using or not using drugs or alcohol and contained an invitation to fill out

a questionnaire. This led to a convenience sample that was more interested in the use of drugs and alcohol than the general Dutch population. Over-sampling was necessary to obtain substantial variation in substance use. Prior to filling out the online questionnaire, respondents read an introduction to the study. They were informed that their participation was anonymous and that they could stop the questionnaire and withdraw their answers at any point. The Ethical Committee of the Trimbos Institute approved this study's procedures. Prizes were randomly distributed among respondents who completed the questionnaire and opted to leave their email address in order to be included in a prize lottery. Email addresses were filed separately from all other data.

Sample

The total study sample consisted of 4,182 Dutch young adults aged 18–25 years who responded to the online questionnaire about expectancies regarding the use of alcohol and drugs. Mean age was 21.1 years, 73.4% of the sample was female, and 82.2% were following or had completed a form of higher education (bachelor's or master's degree). Of all respondents, 35.5% had used ecstasy at least once in their life, and 29.3% had used ecstasy last year. This prevalence is higher than that of the general Dutch young adult population, which is 12.1% in the Netherlands for ages 20–24. This was likely the result of recruitment via a social media campaign that targeted young people with an interest in going out, partying, and substance use, as discussed above.

Measures

The variables in the online questionnaire covered a wide range of behaviours and beliefs concerning alcohol and drug use, but only a subset of these variables was used for the current study.

Demographics: participants were asked about sociodemographic characteristics (e.g., gender, age, education).

Ecstasy use: respondents were asked about their lifetime, last year, and last month use of ecstasy/MDMA (yes/no) and the frequency of their ecstasy use in the past year.

Alcohol use: the Alcohol Use Disorders Identification Test (AUDIT-C) was used to assess hazardous drinking behaviour among respondents. The AUDIT-C covers the following questions: (1) *How often did you have a drink containing alcohol in the past year?* (2) *How many drinks did you have on a typical day when you were drinking in the past year?* (3) *How often did you have six or more drinks on one occasion in the past year?* The AUDIT-C is scored on a scale of 0–12 (scores of 0 reflect no alcohol use). In men, a score of 5 or more is considered an indication for hazardous drinking; in women, a score of 4 or more.

Expectancies: expectancies were measured with 29 dichotomous items reflecting 16 positive and 13 negative possible expectancies of ecstasy use. These 29 items were formulated based on a previous study in which 43 young adults were interviewed about their behaviours, beliefs, and expectancies regarding their use of illegal drugs and inspired by the Ecstasy Use Motives Questionnaire [5, 29], the measure for outcome expectancies constructed by Engels and ter Bogt [9], the Drinking Motives Questionnaire [30, 31], and the Marijuana Motives Questionnaire [32, 33]. Positive expectancies were (1) *relax/chill*; (2) *improve sleep*; (3) *have a good time with friends*; (4) *loosen inhibitions*; (5) *alter perception/expand mind*; (6) *enjoy the taste*; (7) *laugh/have happy/cheerful feelings*; (8) *have more energy*; (9) *improve functioning/better focus*; (10) *experience crazy things/adventures*; (11) *satisfy curiosity*; (12) *distract*

from negative feelings; (13) *reduce stress*; (14) *not be sober*; (15) *shake up routine*; and (16) *have better sex.* Negative expectancies were (1) *forgetting what happened/black out*; (2) *physical problems during use*; (3) *physical problems the day(s) after*; (4) *mental complaints during use*; (5) *mental complaints the day(s) after*; (6) *long-term risks to my mental or physical health*; (7) *arguments/fights with friends or family*; (8) *shame/regret*; (9) *problems with the police*; (10) *it's too expensive*; (11) *loss of control/behaving differently*; (12) *missing appointments/not honouring agreements or obligations*; and (13) *uncertainty about the quality/content of the substance.*

Harmfulness: respondents were asked, "To what extent do you think the use of ecstasy is harmful to your health?" (1 = not at all, 5 = very harmful).

Availability: respondents were asked, "How difficult or easy is it for you to obtain ecstasy?" (1 = very difficult, 5 = very easy).

Social norms: to assess social norms, respondents were asked to think of their 4 closest friends and report (1) how many of these friends have used drugs in the past year (descriptive social norm) and (2) how many of these friends believe it is normal to use drugs (injunctive social norm).

Statistical Analysis

We used latent class analyses to identify subgroups based on answering patterns across the 16 positive and 13 negative expectancies of ecstasy use. The LCAs were conducted in Mplus version 7.2. Models ranging from one to seven classes were considered. These models were compared with respect to overall fit using the Bayesian Information Criteria (BIC), Akaike Information Criteria (AIC), and the adjusted Lo-Mendell-Rubin likelihood ratio test (LMRT). Lower values in AIC and BIC indicate a better model fit. The LMRT indicates a significant model fit improvement from k-1 to k classes. Entropy measures model usefulness and should be as close to one as possible [34]. Entropy values >0.80 indicate "good" classification of individual cases into classes [35].

After the class solution was selected, a multinomial logistic regression analysis was performed in SPSS (version 27.0) to profile the latent classes in terms of demographics, intention to use ecstasy, experience with ecstasy (life and past year), alcohol use, perceptions of harmfulness and availability, injunctive and descriptive social norms.

Results

Determination of the Number of Latent Classes

Model fit information for models with one through seven classes is included in Table 1. The LMR values suggested a six-class solution for an optimal fit, with the *p* value rising at the seven-class solution, whereas the BIC and AIC both pointed towards a four- or five-class model. The entropy values for both the four- and five-class solutions showed that 86% of the sample could be accurately categorised on the basis of their class membership. Considering the BIC value as most reliable [36], a four- or five-class model would best fit the data. A fifth class would come directly out of class 3, dividing it into a

Table 1. Model fit indices for one through seven classes

# of classes	AIC	BIC	Entropy	LMRT	P-LMR
1	120,975.735	121,159.553	N.A.	N.A.	N.A.
2	109,632.587	110,006.561	0.912	11,357,746	0.0000
3	103,778.861	104,342.992	0.893	5,890,179	0.0000
4	*100,855.356*	*101,609.643*	*0.864*	*2,971,626*	*0.0000*
5	99,293.323	100,237.766	0.865	1,615,575	0.0000
6	98,148.682	99,283.282	0.848	1,199,844	0.0001
7	97,452.902	98,777.658	0.831	752,771	0.1781

AIC, Akaike Information Criteria; BIC, Bayesian Information Criteria; LMRT, adjusted Lo-Mendell-Rubin likelihood ratio test; P-LMR, *p* value associated with LMR.

similar class with slightly higher endorsement and a class with very low endorsement rating on all expectancies. Taking into account the interpretability of the classes and theoretical considerations, the four-class model was selected as final.

Latent Class Characteristics

The indicator response patterns for each of the four classes are shown in Figure 1. Class characterisations are based on indicator response, demographics, and covariates as described in Table 2 and Figure 1. Classes were assigned labels based on the cross-class comparisons.

Class 1 (only negative expectancies [13.6%]): the respondents in this class had the lowest probability to endorse positive expectancies of the use of ecstasy and a high probability to endorse negative expectancies. Most notably, members of this class expected physical and mental problems both during the use of ecstasy, in the days after use, and in the long term. They also expected a loss of control or behaving in a different way when under the influence of the drug and were concerned about the quality/content of the substance.

Class 2 (high positive and negative expectancies [23.5%]): the respondents in this class had a high probability of endorsing both positive and negative expectancies. Positive expectancies in particular were to loosen your inhibitions, alter perceptions, experience cheerful, happy feelings, and have more energy as a result of using ecstasy. This class was similar to respondents in class 1 regarding their negative expectancies.

Class 3 (low to moderate positive and negative expectancies [20.6%]): the respondents in this class had a low probability of endorsing positive expectancies and a low to moderate probability of endorsing negative expectancies.

Class 4 (mostly positive expectancies [42.4%]): respondents in this class had a high probability of endorsing positive expectancies, most notably to have cheerful, happy feelings, more energy, have a good time with friends, and loosen inhibitions. Negative expectancies were low to moderately endorsed, most prominently physical complaints during use, physical complaints the day(s) after, mental complaints the day(s) after, and uncertainty about the quality/content of the substance.

Cross-Class Comparisons

Table 3 shows the results of the multivariate multinomial regression model, with each class presenting as a reference category to the other three classes. Variables were added to the model one by one. In the table, statistical significance for each variable explaining the differences between one class and the reference class was indicated by one or more asterisks. Results displayed in Table 3 are described for each of the classes separately.

Class 1 (only negative expectancies), as shown in Table 3, represents the group of respondents that had the least experience with the use of ecstasy (1.6%) and the least intention of using ecstasy in the future. Compared to the other classes, this class perceived the use of ecstasy to be more harmful. Compared to classes 2 and 4, this class consumed less alcohol. Also, compared to classes 2 and 4, this group had fewer best friends who believed it was normal to use drugs. Compared to class 4, respondents in this class found ecstasy more difficult to obtain. This latent class had the lowest percentage of academic students (75.0%) compared to other classes. This class will be called ecstasy-adverse.

Class 2 shows a high endorsement of both positive and negative expectancies. Compared to class 1, respondents in class 2 more often had an intention to use ecstasy (16.2%). When compared to class 4, respondents in class 2 reported fewer intentions to use ecstasy and also less lifetime experience with ecstasy use (18.5%). Members of class 2 perceived the use of ecstasy as more harmful than both classes 3 and 4. They also had more friends who

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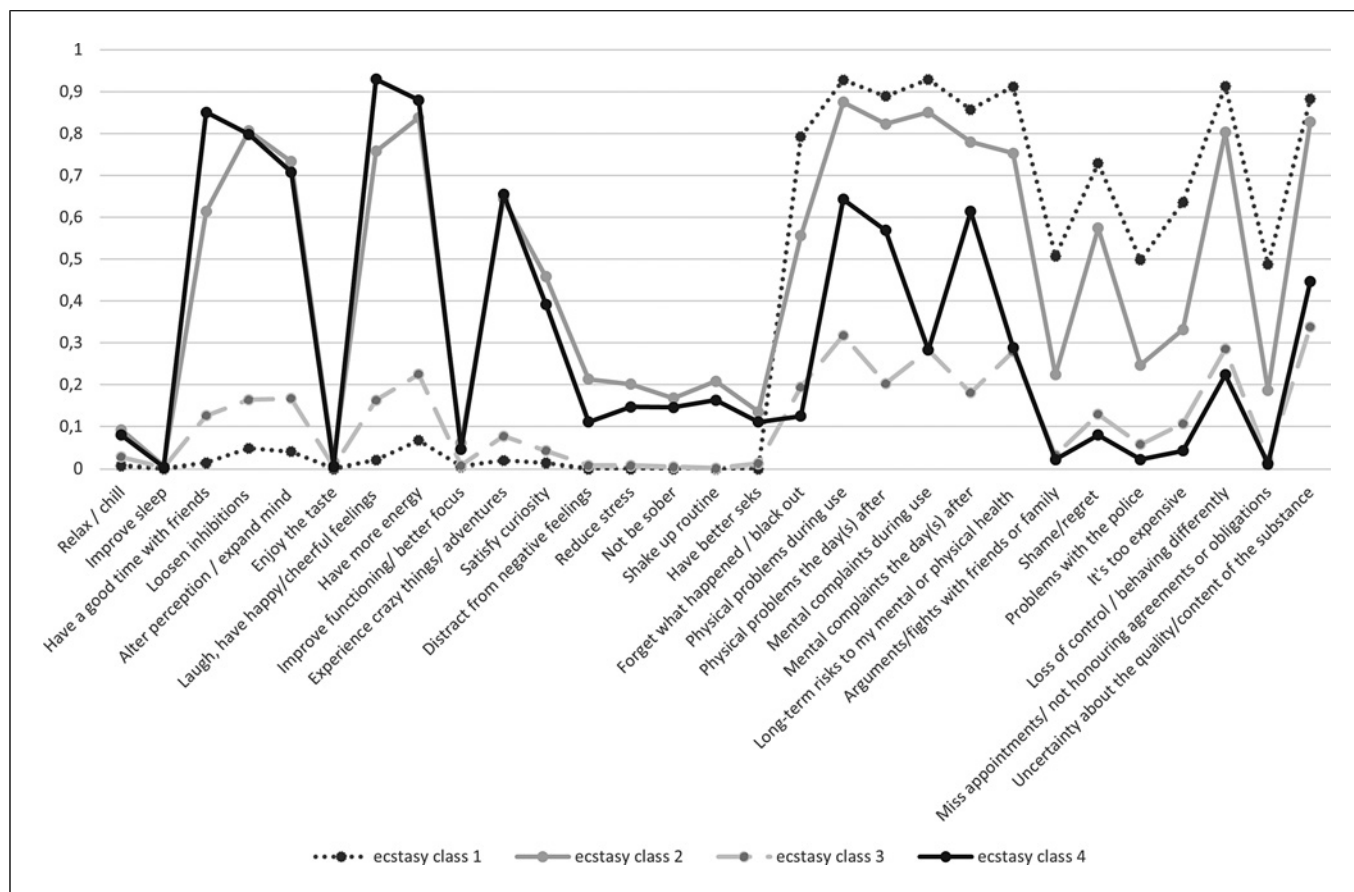
Fig. 1. Indicator response patterns for each of the classes.

believed it was normal to use drugs, and they consumed more alcohol than in classes 1 and 3. Class 2 represented a group with a similar mean age to the other classes, consisting mostly of females (82.4%). The percentage of respondents with an academic education was similar to that of class 4 and higher than that of classes 1 and 3 (84.3%).

Class 3 had a low to moderate score on both positive and negative expectancies. This class seems similar to class 1 in many aspects but does have a higher percentage of respondents with lifetime experience with the use of ecstasy (13%), and the respondents perceive the use of ecstasy as less harmful than classes 1 and 2. This latent class had a lower percentage of female respondents than classes 1 and 2 (72.6%). The percentage of respondents in this class with an academic education was similar to that in class 1 and lower than in classes 2 and 4 (77.6%).

Class 4 respondents predominantly endorse positive expectancies. This class distinguishes itself from the

other classes by including higher percentages of respondents with lifetime (66.7%) and past-year ecstasy use and intention to use ecstasy again (65.6%). Respondents in this class consumed more alcohol, had more friends that find it normal to use drugs, and perceived ecstasy to be less harmful than all other classes. Compared to class 1, respondents in this class found ecstasy relatively easy to obtain. Compared to the other classes, this class had the lowest percentage of female respondents (65.7%) and the highest percentage of academic students (85.7%).

Discussion

This study aimed to identify patterns of ecstasy use expectancies in Dutch young adults. It also explored the association of these expectancies with several other variables: age, gender, education, lifetime use of ecstasy, frequency of use past year, alcohol use, intention to use

Table 2. Demographic, behavioural, cognitive, and social variables of drug use for each class

	Class 1 13.6%, n = 568	Class 2 23.5%, n = 981	Class 3 20.6%, n = 861	Class 4 42.4%, n = 1,772	Overall sample 100%, n = 4,182
Demographics					
Age (mean)	20.80	20.98	20.92	21.37	21.11
Gender (female)	83.5	82.4	72.6	65.7	73.4
Education (vocational vs. academic training) (academic)	75.0	84.3	77.6	85.7	82.2
Behaviour					
Lifetime use (yes)	1.6	18.5	13.0	66.7	35.5
Frequency use past year					
0 times	99.6	86.9	91.9	42.2	70.7
1–5 times	0.4	9.8	7.8	42.2	21.8
6 or more times	0.0	3.4	0.3	15.6	7.5
AUDIT-C (score +4/5)	40.8	63.0	56.9	80.7	66.2
Cognition					
Intention to use XTC this year (yes)	0.2	16.2	9.9	65.6	33.7
Perception of harmfulness (1 = not harmful at all; 5 = very harmful) (mean)	4.80	4.29	4.18	3.54	4.02
Perception of availability/ease of access (1 = very difficult; 5 = very easy) (mean)	2.16	2.64	2.59	3.43	2.90
Social norms					
Best friends who have used drugs in the past year (0–4) (mean)	1.03	1.66	1.37	2.50	1.87
Best friends who consider drug use to be normal (0–4) (mean)	0.95	1.80	1.43	2.70	2.00

XTC this year, perception of harmfulness, perception of availability, social norms.

The most often endorsed positive expectancies from ecstasy use were to laugh and have happy, cheerful feelings; to have more energy; to have a good time with friends; to loosen inhibitions; and to alter perceptions/expand the mind. The negative expectancies that were most often endorsed were physical problems, both during use and the day(s) after use; mental complaints during use; loss of control; uncertainty about the quality/content of the substance. All these expectancies were similar to those found in previous studies among young adults who use ecstasy [5, 9, 10].

Using latent class analyses, we found four distinct patterns of endorsement of positive and negative expectancies. These four classes are notably different in terms of expectancies, but also with regard to intention to use ecstasy, lifetime experience with ecstasy, and perception of harmfulness of ecstasy use. From a drug prevention point of view, this is relevant information that can be used to target young adults who use ecstasy or have the intention to do so. We will now discuss each of the four classes in relation to practical implications for preventive interventions.

Class 1 (only negative expectancies) presents little to no risk of ecstasy use. Respondents in this class have mainly negative expectancies of the use of ecstasy, and as a result, only 0.2% of this class is interested in trying ecstasy in the coming year. Based upon the assumption that, in prevention, vulnerable groups should be prioritised [37], there seems to be little need to plan prevention interventions for this specific class. Also, in this class, exposure to interventions to prevent the use of ecstasy could suggest that the use of ecstasy is more wide-spread than it in fact is, which could lead to a decreased attitude of certainty about not using ecstasy [38, 39].

Class 2 (high positive and negative expectancies) represents a group with a higher risk of ecstasy use than class 1: 16.8% has intentions to use ecstasy this year, respondents in this class have one or two friends who use drugs, and it seems relatively easy for them to acquire ecstasy. They consider ecstasy to be harmful but also have high positive expectancies of its use. Young adults in this class, who have high positive expectancies and an intention to use ecstasy, but no previous experience, are at risk of using ecstasy without the relevant knowledge about protective behaviours. For them, it could be helpful to offer an intervention to

Table 3. Pairwise comparisons of demographic, behavioural, cognitive, and social variables of drug use using multivariate multinomial logistic regression

| | Reference class = 1 | | | Reference class = 2 | | Reference class = 3 |
| | class 2 | class 3 | class 4 | class 3 | class 4 | class 4 |
	OR	OR	OR	OR	OR	OR
Demographics						
Age (mean)	1.014	1.002	1.051	0.989	1.037	1.049
Gender (female)	0.686*	1.279	0.957	1.863***	1.394**	0.748*
Education (vocational vs. academic training) (academic)	0.590***	0.982	0.590**	1.665***	1.001	0.601***
Behaviour						
Lifetime use (yes)	0.403*	0.324**	0.156***	0.804	0.389***	0.484***
Frequency use past year	2.855	1.817	2.750	0.636	0.963	1.514*
AUDIT-C (score +4/5)	0.620***	0.775*	0.505***	1.250	0.815	0.815***
Cognition						
Intention to use XTC this year (yes)	0.095**	0.117*	0.036***	1.233	0.380***	0.308***
Perception of harmfulness (1 = not harmful at all; 5 = very harmful) (mean)	0.362***	0.298***	0.215***	0.823***	0.593***	0.593***
Perception of availability/ease of access (1 = very difficult; 5 = very easy) (mean)	1.048	1.105	1.159**	1.054	1.105	1.048
Social norms						
Best friends that have used drugs in the past year (0–4) (mean)	1.093	1.005	1.124	0.919	1.028	1.119
Best friends who consider drug use to be normal (0–4) (mean)	1.279***	1.100	1.393***	0.860**	1.089	0.484***

***p < 0.001. **p < 0.01. *p < 0.05.

prevent or delay first-time ecstasy use or, if they are intent on using ecstasy, risk reduction information. For example, interventions that have shown some significant effects in the past included a social norms approach focussing on the two or three best friends who do not use ecstasy [40–42]. Risk reduction information would, as suggested in previous studies, consist of information on pill testing services, dosage, the risk of concomitant drug use, and prevention of hyperthermia and hyponatremia [4, 43–45].

Class 3 (low to moderate positive and negative expectancies) shows low endorsement of both positive and negative expectancies. If anything, negative expectancies are a little higher than positive expectancies, especially physical and mental problems during use and in the long term, loss of control, and uncertainty about the quality/content of the substance. When compared to the other classes, this class is most similar to class 1 in all but one variable: perception of harmfulness. Remarkably, this class considers ecstasy to be less harmful than classes 1 and 2. Because in this class, 9.9% of the respondents

report an intention to use ecstasy in the coming year, an intervention for this group should focus on this perception of harmfulness, explaining that there are in fact serious risks with the use of ecstasy [46, 47]. Interventions like this, warning consumers of the specific risks associated with concomitant drug or alcohol use and high dosage pills dominating the current market, have been called critical in reducing MDMA-related harms [4].

Class 4 (mostly positive expectancies) respondents are, of all classes, the most likely to use ecstasy. In this class, 65.6% have the intention to use ecstasy in the coming year. Compared to other classes, they are more often male, have a higher education, drink more alcohol, and have easy access to ecstasy. Interestingly, this class has different negative expectancies from the use of ecstasy than the other classes. Like other classes, they have a high probability of expecting physical complaints during the use of ecstasy and also mental and physical complaints the day(s) after use. But compared to other classes, they have a very low

probability of expecting mental complaints during use and long-term risks to their mental and physical health. Because 66.7% of this class has lifetime experience with ecstasy, much more than other classes, it is possible that their expectancies are more realistic. Preventive interventions in this class could, on the one hand, focus on the relatively low perceived harmfulness, explaining some of the lesser known but serious risks of ecstasy use, such as memory loss and depression. This has previously been suggested in other studies [46, 48]. On the other hand, interventions could focus on protective measures, such as always having a sober friend in your group and not combining alcohol and ecstasy use because it increases the risk of hyperthermia [49]. Because respondents in this class have the most friends with drug use experience, a peer-led intervention could be more effective in connecting with them [50, 51]. Respondents in this class perceive ecstasy as easy to obtain, which suggests that they might benefit from interventions aimed at reducing (ease of) availability.

This study shows that within a convenience sample of Dutch young people, the expectancies from the use of ecstasy widely differ, both between and within groups characterised by use or non-use of ecstasy. Knowledge about these expectancies can be used to develop and implement strategies aimed at preventing and postponing first-time use and tailoring harm reduction measures. The most important takeaway seems to be that one size does not fit all. The variety in expectancies and associated ecstasy use variables warrant an assortment of interventions to cover the range of needs: some would benefit from a social norms approach and harm reduction information, some have a low perception of harmfulness which should be addressed, and others should not be confronted with ecstasy-interventions. This should be taken into account when developing and implementing prevention programs.

Limitations

There are several limitations that should be addressed. First of all, to measure ecstasy expectancies, we constructed a questionnaire, which was based on interviews with 43 young adults about their reasons and expectancies for drug use and inspired by the questionnaire used by Ter Bogt and Engels [9], the Ecstasy Use Motives Questionnaire [29], the Drinking Motives Questionnaire [30, 31], and the Marijuana Motives Questionnaire [32, 33]. This was done in order to be as complete, timely, and relevant as possible, but it meant no validated questionnaire was used. Secondly, because of the relatively low prevalence of ecstasy use in the Dutch general population and even lower prevalence of problematic ecstasy use in terms of high frequency and quantity of use, a general population survey would have been hardly feasible to obtain substantial variation in respondents. So we did not use a representative sample of Dutch young adults, but instead we used convenience sampling. This led to a high response rate of young adults with ecstasy use experience, but also to an over-representation of female respondents and respondents with an academic education. Even though prevalence rates of ecstasy use are higher among men [1], we have no reason to believe that the typologies based on expectancies would substantially differ if the sample was distributed differently with regard to gender and educational background. However, it would be interesting to further investigate the robustness of the classes. Thirdly, the expectancies of ecstasy use can change with drug experience [52], so possibly class membership is dynamic and can change over time. Because of the cross-sectional rather than longitudinal study design, it has not been possible to conduct a latent class transition analysis, which could have given more insight into the ways expectations of ecstasy use change over time.

Conclusions

Although there are numerous studies available on the association between expectancies of alcohol or cannabis use on the one hand and behavioural correlates on the other, similar studies for ecstasy use are rare, especially using a sample of young people both with and without ecstasy use experience [5, 12]. This is the first study to use latent class analysis to study the association between expectancies of ecstasy use and other determinants of ecstasy use behaviour [53]. Understanding expectancies underlying drug use is assumed to be an essential component in the development of effective drug harm prevention and treatment strategies [54]. Treatment and preventive intervention efforts should be tailored to the specific processes that underlie use for different users [21, 22, 55]. This study shows that, based on expectancies young adults have of ecstasy, they can be arranged into four classes. These classes differ in perception of harmfulness and availability, experience with ecstasy use, intention to use ecstasy, and social norms regarding the use of ecstasy. Classes with positive expectancies of ecstasy use are associated with a lower perception of harmfulness, a higher perception of availability, and more friends who have used drugs. These factors should be taken into consideration when developing and implementing preventive interventions.

Statement of Ethics

Subjects have given their written informed consent to participate in the study. The study protocol was reviewed and approved by the Ethical Committee of the Trimbos Institute, approval number TET-65-1807.

Conflict of Interest Statement

No conflict was declared.

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Author Contributions

M.J., A.B., S.O., M.K., and T.B. set the scope and designed the study. M.J. and A.B. performed the data analyses under guidance of M.K. M.J. wrote the first draft of the manuscript. T.B., A.B., S.O., and M.K. contributed to the manuscript's structure and revised the manuscript for important intellectual content. All authors approved the final version of the manuscript.

Data Availability Statement

All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

References

1 European Monitoring Centre for Drugs and Drug Addiction. European drug report 2020: Trends and Developments. 2020.

2 United Nations. Drug market trends: cocaine, aphetamine type stimulants. United Nations publication; 2021 World drug report 2021.

3 van Laar MW, et al. Nationale Drug Monitor Nationale Drug Monitor - kerncijfers en ontwikkelingen 2021," 2022. [Online]. Available from: https://repository.wodc.nl/handle/20.500.12832/3165.

4 Roxburgh A, Sam B, Kriikku P, Mounteney J, Castanera A, Dias M, et al. Trends in MDMA-related mortality across four countries. Addiction. 2021;116(11):3094–103.

5 M ter Bogt TF, Engels RCME. 'Partying' hard: party style, motives for and effects of MDMA use at rave parties. Subst Use Misuse. 2005;40(9–10):1479–502.

6 Panagopoulos I, Ricciardelli LA. Harm reduction and decision making among recreational ecstasy users. Int J Drug Policy. 2005;16(1):54–64.

7 Hysek CM, Schmid Y, Simmler LD, Domes G, Heinrichs M, Eisenegger C, et al. MDMA enhances emotional empathy and prosocial behavior. Soc Cogn Affect Neurosci. 2014;9(11):1645–52.

8 Krolikowski AM, Koyfman A. Methamphetamine and MDMA: 'Safe' drugs of abuse. Afr J Emerg Med. 2014;4(1):34–8.

9 Engels CME, Ter Bogt T. Outcome expectancies and ecstasy use in visitors of rave parties in The Netherlands. Eur Addict Res. 2004;10(4):156–62.

10 McElrath K, McEvoy K. Negative experiences on Ecstasy: the role of drug, set and setting. J Psychoactive Drugs. 2002;34(2):199–208.

11 Martins SS, Storr CL, Alexandre PK, Chilcoat HD. Do adolescent ecstasy users have different attitudes towards drugs when compared to marijuana users? Drug Alcohol Depend. 2008;94(1–3):63–72.

12 Smerdon MJ, Francis AJP. Reward sensitivity and outcome expectancies as predictors of ecstasy use in young adults. Addict Behav. 2011;36(12):1337–40.

13 Egan ST, Kambouropoulos N, Staiger PK. Rash-impulsivity, reward-drive and motivations to use ecstasy. Pers Individ Dif. 2010;48(5):670–5.

14 Holt LJ, Looby A. Factors that differentiate prescription stimulant misusers from those at-risk for misuse: expectancies, perceived safety, and diversion. Subst Use Misuse. 2018;53(7):1068–75.

15 Boys A, Marsden J, Strang J. Understanding reasons for drug use amongst young people: a functional perspective. Health Educ Res. 2001;16(4):457–69.

16 Fendrich M, Wislar JS, Johnson TP, Hubbell A. A contextual profile of club drug use among adults in Chicago. Addiction. 2003;98(12):1693–703.

17 Soellner R. Club drug use in Germany. Subst Use Misuse. 2005;40(9–10):1279–93.

18 Vervaeke HKE, Benschop A, Korf DJ. Fear, rationality and opportunity: reasons and motives for not trying ecstasy. Drugs Educ Prev Policy. 2008;15(4):350–64.

19 Trudeau L, Spoth R, Lillehoj C, Redmond C, Wickrama KAS. Effects of a preventive intervention on adolescent substance use initiation, expectancies, and refusal intentions. Prev Sci. 2003;4(2):109–22.

20 Clark HK, Ringwalt CL, Shamblen SR. Predicting adolescent substance use: the effects of depressed mood and positive expectancies. Addict Behav. 2011;36(5):488–93.

21 Dow SJ, Kelly JF. Listening to youth: adolescents' reasons for substance use as a unique predictor of treatment response and outcome. Psychol Addict Behav. 2013;27(4):1122–31.

22 Cooper ML, Kuntsche E, Levitt A, Barber LL, Wolf S. Motivational models of substance use: a review of theory and research on motives for using alcohol, marijuana, and tobacco. April. 2015.

23 de Vries H. An integrated approach for understanding health behavior; the I-change model as an example. Psychol Behav Sci Int J. 2017;2(2).

24 Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. Dec. 1991;50(2):179–211.

25 NK Janz, MH Becker. "The health Belief model: a decade later". Health Educ Q. 1984;11:1–47.

26 Kasten S, Van Osch L, Candel M, De Vries H. The influence of pre-motivational factors on behavior via motivational factors: a test of the I-Change model. BMC Psychol. 2019;7(1):7–12.

27 Rigg KK. Motivations for using MDMA (Ecstasy/Molly) among african Americans: implications for prevention and harm-reduction programs. J Psychoactive Drugs. 2017;49(3):192–200.

28 Hors-Fraile S, Malwade S, Luna-Perejon F, Amaya C, Civit A, Schneider F, et al. Opening the black box: explaining the process of basing a health recommender system on the I-change behavioral change model. IEEE Access. 2019;7:176525–40.

29 Davis AK, Rosenberg H. Application of the passionate attachment model to recreational use of MDMA/ecstasy. J Psychoactive Drugs. 2015;47(1):24–9.

30 Kuntsche E, Knibbe R, Gmel G, Engels R. Why do young people drink? A review of drinking motives. Clin Psychol Rev. 2005; 25(7):841–61.

31 Cooper ML, Frone MR, Russell M, Mudar P. Drinking to regulate positive and negative emotions: a motivational model of alcohol use. 1995. [Online]. Available from: https:// s3.amazonaws.com/academia.edu.documents/ 43821128/Goal_Conflicts_Concepts_Findings_ and_Con20160317-1243-1q1t20t.pdf?response- content-disposition=inline%3B.filename% 3DGoal_Conflicts_Concepts_Findings_and_ Con.pdf&X-Amz-Algorithm=AWS4-HMAC- SHA256&X-Am.

32 Lee CM, Neighbors C, Hendershot CS, Grossbard JR. Development and preliminary validation of a comprehensive Marijuana motives questionnaire. J Stud Alcohol Drugs. 2009;70(2):279–87.

33 Blevins CE, Banes KE, Stephens RS, Walker DD, Roffman RA. Motives for marijuana use among heavy-using high school students: an analysis of structure and utility of the Comprehensive Marijuana Motives Questionnaire. Addict Behav. 2016;57:42–7.

34 Nylund-Gibson K, Choi AY. Ten frequently asked questions about latent class analysis. Transl Issues Psychol Sci. 2018;4(4):440–61.

35 Clark S, Muthén BO. Relating latent class analysis results to variables not included in the analysis. StatisticalInnovations.com; 2009. p. 1–55.

36 Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. Struct Equ Model. 2007;14(4):535–69.

37 Lloyd C. Risk factors for problem drug use: identifying vulnerable groups. Drugs Educ Prev Policy. 1998;5(3):217–32.

38 Clarkson JJ, Tormala ZL, Rucker DD, Dugan RG. The malleable influence of social consensus on attitude certainty. J Exp Soc Psychol. 2013;49(6):1019–22.

39 Barden J, Tormala ZL. Elaboration and attitude strength: the new meta-cognitive perspective. Soc Personal Psychol Compass. 2014;8(1):17–29.

40 DR Foxcroft, MT Moreira, NML Almeida Santimano, LA Smith. "Social norms information for alcohol misuse in university and college students,". Cochrane Database Syst. Rev. 2015;12:

41 GJ Botvin, "Preventing drug abuse in schools: social and competence enhancement approaches targeting individual-level etiologic factors,". Addict Behav. 2000;25: 887–97.

42 Chakravarthy B, Shah S, Lotfipour S. Adolescent drug abuse: awareness & prevention. Indian J Med Res. 2013;137(6):1021–3.

43 Rigg KK, Sharp A. Deaths related to MDMA (ecstasy/molly): prevalence, root causes, and harm reduction interventions. J Subst Use. 2018;23(4):345–52.

44 Palamar JJ, Acosta P, Cleland CM. The influence of viewing a headline about ecstasy/ Molly adulteration on future intentions to use. J Subst Use. 2020;25(1):95–100.

45 Betzler F, Helbig J, Viohl L, Ernst F, Roediger L, Gutwinski S, et al. Drug checking and its potential impact on substance use. Eur Addict Res. 2021;27(1):25–32.

46 Cohen IV, Makunts T, Abagyan R, Thomas K. Concomitant drugs associated with increased mortality for MDMA users reported in a drug safety surveillance database. Sci Rep. 2021;11(1):5997–9.

47 Van J. Amsterdam, "Fatal and non-fatal health incidents related to recreational ecstasy use. 2020.

48 Carlson RG, Wang J, Falck RS, Siegal HA. Drug use practices among MDMA/ecstasy users in Ohio: a latent class analysis. Drug Alcohol Depend. 2005;79(2):167–79.

49 van Amsterdam J, Brunt TM, Pierce M, van den Brink W. Hard boiled: alcohol use as a risk factor for MDMA-induced hyperthermia: a systematic review. Neurotox Res. 2021; 39(6):2120–33.

50 Georgie J M, Sean H, Deborah CM, Matthew H, Rona C. Peer-led interventions to prevent tobacco, alcohol and/or drug use among young people aged 11-21 years: a systematic review and meta-analysis. Addiction. 2016; 111(3):391–407.

51 Cuijpers P. Peer-led and adult-led school drug prevention: a meta-analytic comparison. J Drug Educ. 2002;32(2):107–19.

52 Schafer J, Brown SA. Marijuana and cocaine effect expectancies and drug use patterns. J Consult Clin Psychol. 1991; 59(4):558–65.

53 de Jonge MC, Bukman AJ, van Leeuwen L, Onrust SA, Kleinjan M. Latent classes of substance use in young adults: a systematic review. Subst Use Misuse. 2022;57(5): 769–85.

54 Adams JB, Heath AJ, Young SE, Hewitt JK, Corley RP, Stallings MC. Relationships between personality and preferred substance and motivations for use among adolescent substance abusers. Am J Drug Alcohol Abuse. 2003;29(3):691–712.

55 Stockings E, Hall WD, Lynskey M, Morley KI, Reavley N, Strang J, et al. Prevention, early intervention, harm reduction, and treatment of substance use in young people. Lancet Psychiatry. 2016;3(3):280–96.