

EMPIRICAL PAPER

Using the Confidence Interval-Based Estimation of Relevance Approach to Identify Determinants of Cannabis Use among High School Students in the Netherlands

Ymke Joline Evers*, Hans Bernard Dupont*[†], Rik Crutzen* and Pauline Heuperman[†]

Aims: The Confidence Interval-Based Estimation of Relevance (CIBER) approach was used to assess the most relevant psychosocial determinants of both the intention to use cannabis and the intention to reduce or quit cannabis use among high school students.

Methods: In 2017, 206 Dutch high school students completed questionnaires. Questionnaires measured cannabis use in the past six months, intention to use cannabis in the upcoming six months, intention to reduce or quit cannabis use in the upcoming six months, psychosocial determinants, and sociodemographic characteristics. The CIBER approach was used to estimate the relevance of determinants by calculating and visualizing confidence intervals for the means and correlation coefficients for intention to use cannabis as well as intention to reduce or quit cannabis use.

Results: Cannabis use was reported by 28% (57/206), and 26% (54/206) had the intention to use cannabis. Risk perception, attitude, and the descriptive norm were evaluated as the most relevant determinants of the intention to use cannabis. Among cannabis users, 49% (28/57) had the intention to reduce or quit. Attitude and habit were evaluated as the most relevant determinants of the intention to reduce or quit cannabis use among cannabis users.

Conclusion: Cannabis use was prevalent among Dutch high school students. Findings suggest that interventions aimed at preventing cannabis use among the general school population might best focus on the risk perception, attitude, and the descriptive norm, whereas interventions aimed at reducing cannabis use among cannabis users might best focus on attitude and habits.

Keywords: cannabis use; determinants; high school students; CIBER approach

Introduction

For over two decades, cannabis has been the most widely used illicit drug by adolescents in high-income countries. The main effects of the drug are that it is a relaxant, an appetite stimulant and a sexual stimulant (Sussman, Stacy, Dent, Simon & Johnson, 1996). The Netherlands has a policy of toleration regarding cannabis. This means that the sale of cannabis in coffee shops is a criminal offence but the Public Prosecution Service does not prosecute coffee shops for this offence. Neither does the Public Prosecution Service prosecute members of the public for possession of small quantities of cannabis (Grund & Breeksema, 2013). In the Netherlands, 22% of high school students in the age of 15–16 years old that has ever used cannabis, which is higher than the European average of 16% (Van Laar & Ooyen-Houben, 2016). Last month prevalence of

cannabis use among Dutch high school students is 5% and 45% of these students used cannabis during school time (Van Laar & Ooyen-Houben, 2016). Cannabis use has been linked to multiple negative outcomes in adolescents, including impaired respiratory problems, violence, injury, sexual risk behaviour, poorer educational outcomes or school drop-out, psychosis, mental illness, risk of dependence, morbidity and mortality in later life (Copeland & Swift, 2009; Fischer, Rehm & Hall, 2009; Solowij, 2010; Horwood et al., 2010; Macleod et al., 2004; Moore et al., 2007; Sillins et al., 2014). Hence, a need exists for evidence-based interventions aimed at decreasing cannabis use among high school students to prevent health- and school-related problems. When developing an intervention aimed at behaviour change, one of the crucial steps in the development process is to select the most relevant determinants (Bartholomew et al., 2016). These determinants can be seen as the buttons one needs to push to establish behaviour change. Three main types of determinants can be identified: environmental, genetic, and psychosocial determinants. The focus in this paper is on psychosocial determinants, given that all environmental

* Health Education and Promotion, Maastricht University, Maastricht, NL

[†] Prevention Department, Mondriaan, Heerlen, NL

Corresponding author: Ymke Joline Evers (ymkeevers@gmail.com)

and genetic influences eventually operate through psychosocial determinants and psychosocial determinants are most likely to be changeable by an intervention (Bartholomew et al., 2016).

Psychosocial determinants of cannabis use among adolescents

Previous studies showed that the Theory of Planned Behaviour (TPB) can be useful in predicting intention and cannabis use (Malmberg et al., 2011; Ito, Henry, Cordova & Bryan, 2015). Intention is described as the strongest predictor of behaviour (Ajzen, 1985). Indeed, increasing intentions to use over a one year period predicted greater cannabis use (Ito et al., 2015). The TPB postulates that one's intention to adopt or maintain a behaviour is a function of three factors: attitude, subjective norm, and self-efficacy (Ajzen, 1985). Attitude can be described as the sum of the perceived advantages and perceived disadvantages of a behaviour. Previous studies have showed that attitude helped to explain one's frequency of cannabis use (Simons & Arens, 2007) and intention to use cannabis (Malmberg et al., 2012; Roscoät, Gogordan, Guignard, Wilguin & Beck, 2015). The subjective norm includes the perception of a person about whether other people approve or disapprove the behaviour and motivation to comply to this. Pressure from peers to use substances is has been positively related to substance-use intentions and behaviours (Scull, Kupersmidt, Elmore & Benson, 2010). Self-efficacy can be described as one's degree of confidence in the ability to perform the behaviour in the face of various obstacles. Previous studies showed that low refusal skills and self-efficacy were associated with increased cannabis use (Walker, Neighbors, Rodriguez, Stephens & Roffman, 2011). Additional determinants of cannabis use have been identified in previous studies. The descriptive norm, or beliefs about whether most people perform the behaviour, has been related to substance use in adolescents (Berkowitz, 2003; D'Amico & McCarthy, 2006). Adolescents have a tendency to overestimate the extent to which peers use cannabis (Van Laar & Ooyen-Houben, 2016). This overestimation lowers the threshold for adolescents to start using cannabis themselves or to increase their cannabis use, since adolescents like to conform their behaviour with the behaviour of the majority (Nolan, Schultz, Cialdini, Goldstein & Griskevicius, 2008). Habits can be defined as a learned behavioural responses to situational cues (Orbell, 2013). Adolescents often use cannabis to feel more comfortable in insecure social situations and to cope with stress and anxiety (Lee, Neighbors & Woods, 2006), and when they experienced using cannabis as useful to attain these needs, the behaviour could become habitual. Ideally, all determinants associated with cannabis use would be addressed in an behavioural change intervention. However, there are limits in terms of resources available for intervention development and the amount of content that participants of an intention can be exposed to (Crutzen, Peters & Noijen, 2017). Hence, one needs to establish which of the potential determinants are the most relevant given the target behaviour, population, and context.

Confidence-Interval Based Estimation of Relevance (CIBER) approach

The Confidence-Interval Based Estimation of Relevance (CIBER) approach has been developed as a tool to select the most relevant determinants of a behaviour to inform the focus of behavioural change interventions (Crutzen, Peters & Noijen, 2017; Peters & Crutzen, 2018). This approach combines two types of analyses: (1) assessing the univariate distribution of each determinant, or the current status of a determinant, and (2) assessing associations to behaviour. Those determinants that are not associated to the behaviour will often be the least likely candidates to intervene upon. The univariate distributions are important because strongly skewed distributions have implications for how a determinant should be targeted. For example, right-skewed positively associated determinants imply a need for change, as most do not have the desired value yet. Decisions in the CIBER approach are based on the confidence intervals for the means and correlation coefficients. To assess this information on different determinants simultaneously, the CIBER approach uses data visualization. Visualization facilitates comparison between the determinants, which is necessary when making selections. Moreover, visualization foregoes the seeming accuracy and objectivity afforded by numbers.

This study aims to identify the most relevant psychosocial determinants for intention to use cannabis among the general school population and intention to quit cannabis among high school students using cannabis.

Methods

Study design

In 2017, students between the age of 12 and 19 years old were asked to fill in a paper questionnaire during school breaks at the school canteens of five different high school in Maastricht, the Netherlands. Questionnaires were distributed by the researcher. Though it was a convenience sample, we sought, as far as possible, to balance the sample of participants according to gender, age, and educational level. Respondents were asked for their approval of participation by signing an informed consent at the start of the questionnaire.

Measures

Outcomes

Three outcome variables were assessed: actual cannabis use, intention to use cannabis, and intention to reduce/quit cannabis use. Actual cannabis use in the past six months and intention to use cannabis in the following six months were measured on a five-point Likert Scale with the following answer options: never, monthly or less, 2–4 times per month, 2–3 times per week, or 4 or more times per week. Intention to reduce/quit cannabis use in the following six months was measured among respondents who indicated to have used cannabis in the following six months. Answers were given of a five-point Likert Scale with the following answer options: certainly not, probably not, maybe/maybe not, probably yes, or certainly yes. Questions, answer options, and the time period of six months was derived

from the validated questionnaire: The Cannabis Use Disorder Identification Test (Adamson et al., 2016).

Determinants

Items measuring the concepts risk perception, attitude, subjective norm, descriptive norm, social pressure, skills, self-efficacy, and habit were developed to determine potential determinants of cannabis use (**Table 1**). Items were based on a literature study that identified all potential determinants of cannabis use. If the total score of items had good internal reliability, with omega higher than 0.8 for concepts with more than two items or correlation higher than 0.8 for concepts with two items, a mean score was calculated.

Statistical analyses

Frequency tables were used to obtain information on the distribution of background variables in the sample of respondents. Descriptive statistics (means and standard deviations) were used to acquire information on cannabis use, intention to use cannabis, and intention to reduce/quit cannabis use. Bivariate correlation was assessed between cannabis use and intention to use can-

nabis. In further analyses, intention to use cannabis was used as a proxy for cannabis use.

The CIBER approach was used to assess the most relevant determinants for intention to use cannabis and intention to reduce/quit. Confidence intervals for the means of determinants and correlations between determinants and intention to use cannabis were calculated and visualized for all respondents. Confidence intervals for the means and correlations between determinants and intention to reduce/quit were calculated and visualized for all respondents who reported cannabis use in the past six months. Diamond plots are used in the visual representation as an efficient method to represent both the mean and the confidence interval bounds, without drawing the attention to the confidence interval bounds. The fill colours of the diamonds show the degree of skewness of determinants (red: scores are left-skewed, blue: scores are around the middle of the scale, green: scores are right-skewed). When the mean of the determinant was skewed in favour of cannabis use (e.g. a positive attitude towards cannabis use) and that determinant was significantly associated with one of the outcomes, the determinant can be seen as relevant. The confidence intervals for the

Table 1: Measurement of determinants.

| Determinants | Example question | Answering scale | Answering options | Items | Internal consistency | Interpretation |
|------------------|---|-------------------------|--|-------|----------------------|---|
| Risk perception | <i>I think cannabis use causes health problems for me</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 2 | 0.830 | A higher score indicates having a higher risk perception of consequences of cannabis |
| Attitude | <i>I think cannabis use is fun</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 5 | 0.802 | A higher score indicates having a more positive attitude towards cannabis |
| Subjective norm | <i>I think my friends consider cannabis use to be a cool thing to do</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 1 | | A higher score indicates that cannabis is more considered to be a cool thing to do |
| Descriptive norm | <i>The majority of my friends uses cannabis</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 2 | 0.916 | A higher score indicates thinking that the majority of friends/contacts uses cannabis |
| Social pressure | <i>I experience pressure from my friends to use cannabis</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 1 | | A higher score indicates experiences more social pressure to use cannabis |
| Skills | <i>I know how to refuse cannabis when I do not want to use it</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 1 | | A higher score indicates having more skills to refuse cannabis |
| Self-efficacy | <i>I often fail to say no to friends who offer me cannabis</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 1 | | A higher score indicates being more able to refuse cannabis |
| Habit | <i>While chilling with my friends, I smoke a joint without having to think about it</i> | Five-point Likert Scale | Totally disagree, disagree, not agree/not disagree, agree, totally agree | 2 | 0.849 | A higher score indicates using cannabis more as a habitual reaction |

explained variance (R^2) of the two outcomes, intention to use and intention to reduce/quit, were calculated and depicted at the top of the figures. The package ‘userfriendlyscience’ (Peters, 2017) for the open source software R (R Development Core Team, 2014) was used for this purpose.

Results

Study population

A total of 206 high school students started the questionnaire. Of those, 199 (96.6%) respondents fully completed the questionnaire. The number of respondents was nearly equal for the five different high school: 42 (20.4%) at school A, 42 (20.4%) at school B, 40 (19.4%) at school C, 49 students at school D (23.9%), and 33 at school E (16.0%). The sample consisted of slightly more females than males (55.3% vs. 44.2%). Age ranged from 12 to 19, with an average of 15.01 (SD = 1.54). A lower educational level was reported by 110 (53.4%) respondents and a higher educational level by 96 (46.6%) respondents. The majority of respondents (194; 94.2%) was born in the Netherlands, 7 (3.4%) respondents were born in another western country, and 5 (2.4%) respondents were born in a non-western country (Table 2).

Cannabis use

The majority of respondents (72.3%) indicated not to have used cannabis in the past six months. The majority of respondents (74.1%) also indicated to not having the intention to use cannabis in the following six months. Cannabis

use and intention to use cannabis were significantly positively correlated ($r = 0.858$; $p < 0.01$). Of respondents who reported cannabis use in the past six months, half (49.1%) reported the intention to reduce or quit cannabis use.

Determinants of intention to use cannabis

Attitude, the descriptive norm and habit were significantly positively associated with intention to use cannabis (Figure 1). Risk perception and self-efficacy were significantly negatively associated with intention to use cannabis. The relevance of self-efficacy and habit is relatively low, because the scores indicate that respondents already have sufficient refusal self-efficacy and did not think automatically about using cannabis in certain situations. Risk perception, attitude, and the descriptive norm can be viewed as the most relevant determinants of cannabis use, because they are associated with intention and the scores of these determinants are on the middle of the scale (Figure 1). This indicates that there are subgroups not considering the risks of cannabis use, holding a positive attitude towards cannabis use, and thinking that the majority of their friends/contacts use cannabis. Exact values for means and correlations can be found in Appendix I.

Determinants of intention to reduce/quit cannabis use

Attitude and habit were significantly associated with the intention to reduce/quit cannabis use (Figure 2). Attitude and habit can be viewed as relevant, given that the scores

Table 2: Descriptives, means and standard deviations of outcomes.

| | N(%) | Mean (SD) |
|---|-------------|-------------|
| Cannabis use in past six months (N = 206)^a | | 1.58 (1.12) |
| Never | 149 (72.3%) | |
| Monthly or less | 24 (11.7%) | |
| 2–4 times per month | 14 (6.8%) | |
| 2–3 times per week | 8 (3.9%) | |
| ≥4 times per week | 11 (5.3%) | |
| Intention to use cannabis in following six months (N = 206)^a | | 1.54 (1.07) |
| Never | 152 (74.1%) | |
| Monthly or less | 20 (9.8%) | |
| 2–4 times per month | 17 (8.3%) | |
| 2–3 times per week | 7 (3.4%) | |
| ≥4 times per week | 9 (4.4%) | |
| Intention to reduce/quit cannabis use in following six months (N = 57)^b | | 2.88 (1.42) |
| Certainly not | 9 (15.8%) | |
| Probably not | 20 (35.1%) | |
| Maybe/maybe not | 10 (17.5%) | |
| Probably yes | 5 (8.8%) | |
| Certainly yes | 13 (22.8%) | |

Note: N's deviate from the total sample due to missing values. Percentages represent valid percentages. Means and standard deviations are based on respondents with valid scores.

^aScale 1 (never) – 5 (4 or more times per week).

^bScale 1 (certainly not) – 5 (certainly yes).

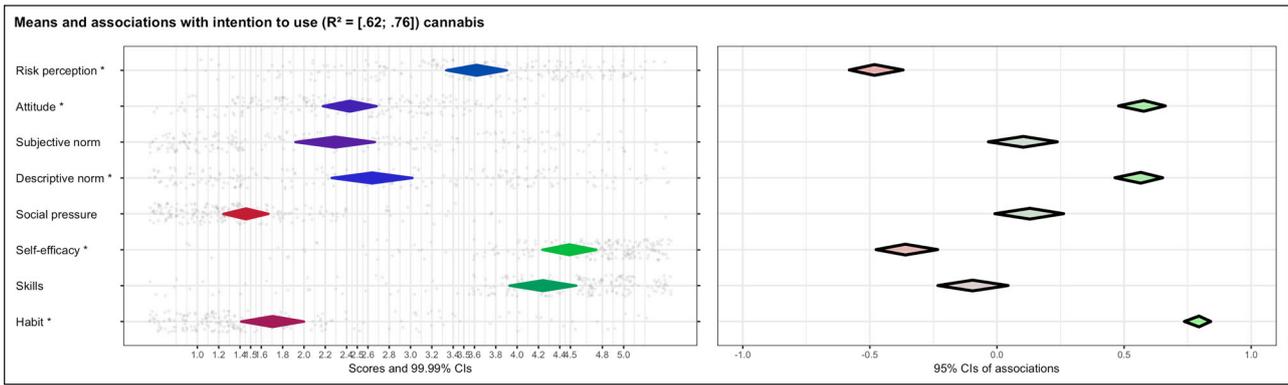


Figure 1: Confidence intervals for means of determinants and associations with intention to use cannabis (N = 206). *Notes:* Colours indicate the degree of skewness (red: scores are left-skewed, blue: scores are around the middle of the scale, green: scores are right-skewed). The confidence interval of the explained variance (R^2) of intention to use are depicted at the top of the figure. Scale: 1 (totally disagree) – 5 (totally agree). * Significant association with outcome.

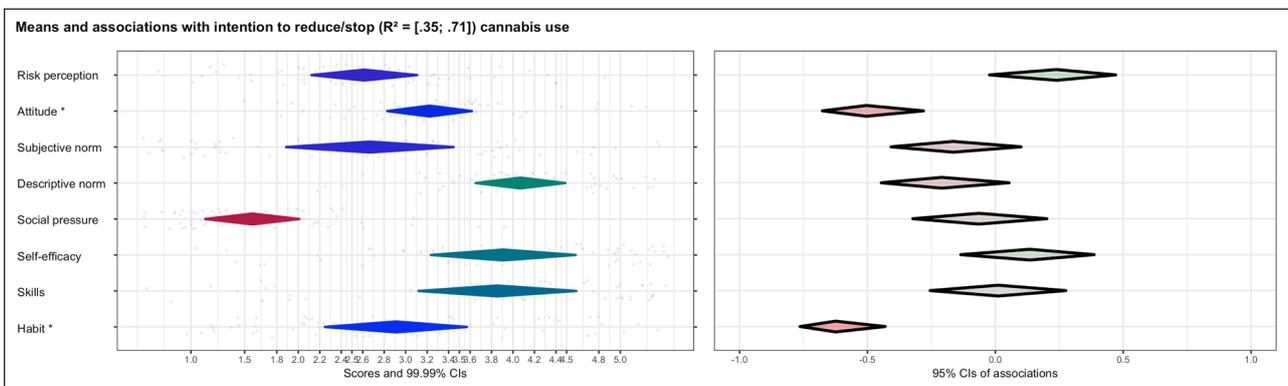


Figure 2: Confidence intervals for means of determinants and associations with intention to reduce/quit cannabis use among cannabis users (N = 57). *Notes:* Colours indicate the degree of skewness (red: scores are left-skewed, blue: scores are around the middle of the scale, green: scores are right-skewed). The confidence interval of the explained variance (R^2) of intention to reduce/stop are depicted at the top of the figure. Scale: 1 (totally disagree) – 5 (totally agree). * Significant association with outcome.

in the middle indicate that there are subgroups holding a positive attitude towards cannabis use and thinking about cannabis as an automatic response to certain situations (Figure 2). Exact values for means and correlations can be found in Appendix II.

Discussion

The current study showed that almost thirty percent of high school students used cannabis at least once in the past six months. Among respondents who reported cannabis use, half reported the intention to reduce or quit cannabis use in the following six months. The CIBER approach was used to assess the determinants that are most relevant to target in a behavioural change intervention. Within the CIBER approach, potential determinants of a behaviour are visualized in terms of their current status and their association with the outcome of interest. We found that risk perception, attitude, and the descriptive norm might be viewed as the most relevant determinants for intention to use cannabis. Attitude and habit might be

viewed as the most relevant determinants for the intention to quit/reduce cannabis use.

Our study results suggest that the risk perception, attitude, and the descriptive norm are the most relevant determinants to focus on in an intervention that prevents cannabis use in the general school population. Having more positive than negative effect expectancies about cannabis use was associated with a stronger intention to use cannabis. Regarding the current status, the scores on the middle of the scale of attitude and risk perception indicate that there are subgroups who hold more positive than negative effect expectancies. Some subgroups thought that cannabis use offered them fun, relaxation, growth in personal development, and helped them coping with stress and making a statement against their parents, and they did not think that cannabis use would cause health- or school-related problems. A previous study among college students (Simons & Arens, 2007) showed that higher frequencies of cannabis use were observed in consumers with positive cannabis expectancies, whereas lower frequencies

were associated with negative expectancies. This indicates that students who hold positive beliefs might be at risk to frequently use cannabis. In a behavioural change intervention, it might be useful to provide tailored information on the possible harms of frequent cannabis use, while acknowledging the positive effects (Peters, Ruiter & Kok, 2013; Petty et al., 2009; Prochaska, Redding & Evers, 2015). Thinking that the majority of peers use cannabis was also associated with a stronger intention to use cannabis. This finding supports previous research that showed that the perception of the amount to which peers use cannabis increases the frequency of one's own actual cannabis use and intention to use cannabis (D'Amico & McCarthy, 2006; Nolan et al., 2008; Tsering & Pal, 2009). The scores on the middle of the scale indicated that there are subgroups who think that the majority of their peers use cannabis. Previous studies already showed that adolescents tend to overestimate the extent to which peers use cannabis (Kilmer et al., 2015; Van Laar & Ooyen-Houbem 2016). The most plausible explanation for the relation between the descriptive norm and cannabis use is that adolescents tend to conform to the behaviour of the majority (Nolan et al., 2008; Tsering & Pal, 2009). Correcting the norm, or denormalisation, among subgroups that overestimate the extent to which peers use cannabis could prevent adolescents from conforming their behaviour to a misperception about the amount of cannabis used by their peers. The Social Norm Approach (Van Bokhorst, Kraag, Dupont & Kok, 2017) seems to be a promising method for denormalisation in alcohol and drug education.

Attitude and habit might be evaluated as relevant determinants to focus on in an intervention to motivate cannabis users to reduce or quit. Having more negative effect expectancies was associated with a higher intention to reduce or quit cannabis use. One previous study showed that having negative effect expectancies, learned through experience or observation, could decrease the frequency of cannabis use (Simons & Arens, 2007). However, in an intervention it might be more effective to focus on the positive consequences of reducing or quitting, since gain framing has been proven to be more effective to change attitudes for actions which do not entail risks (O'Keefe & Jensen, 2007). The results of this study showed that respondents who used cannabis often used it as an automatic response to specific situations, such as hanging out with friends. The less adolescents use cannabis as an automatic response, the more likely they are to reduce or quit cannabis use. Using cannabis can become habitual when it serves certain goals, such as being more social or coping with stress or anxiety, and it provides satisfactory experiences in attaining these goals (Lee et al., 2006). One explanation for the lower intention to reduce or quit among these habitual cases might be that respondents do not reflect on their use as being problematic but automatically use it in certain situations. Attractive alternatives could be offered in an intervention to adolescents for which cannabis use has become habitual. Specific action and coping plans could be offered for this purpose (Latham & Locke, 2007; Wood & Neal, 2007).

This study should be viewed in light of several methodological limitations. One general limitation was the lack of

information on high school students who did not participate in this study. Therefore, we cannot ensure that the cannabis use prevalence and beliefs can be generalized to other high school students in the Netherlands. The questionnaire was developed to be attractive for all students and it was distributed to students regardless of their drug use status. Almost none of the respondents refused participation, which positively influences the representativeness of our sample. Participants may be reluctant to report cannabis use, because of social desirability. However, questionnaires were completed at school canteens without presence of teachers which could have decreased reluctance to report cannabis use. The cannabis use prevalence might even be slightly overestimated, because of social pressure by friends. Although the CIBER approach was a helpful method to visualize which determinants could be important to focus on, it does not offer the possibility to include interactions between determinants or correct for confounding factors. Other factors, such as critical life events, have been related to cannabis use in previous studies (Hyman & Sinha, 2008). Furthermore, the small sample size in assessing the determinants for the intention to reduce or quit cannabis use among cannabis users has contributed to broad confidence intervals (Moinester & Gottfried, 2014).

Conclusion

To our knowledge, this is the first study to use the CIBER approach to identify the most relevant determinants to focus on in an intervention to reduce cannabis use among high school students. The findings suggest that an intervention with the aim of preventing cannabis use among the general school population might best be focused on positive and negative expectations about cannabis and the descriptive norm. An intervention aimed at reducing cannabis use among high school students who regularly use cannabis might best be focused on positive and negative expectations as well as habit strength. Longitudinal research is needed to further investigate the predictive value of psychosocial determinants and actual cannabis use over time.

Appendix I

Appendix 1: Exact values for means of determinants and correlations with intention to use cannabis (N = 206).

| | Means (SD) | Correlations (R) with intention to use cannabis (p-value) |
|------------------|-------------|---|
| Risk perception | 3.67 (1.03) | -0.53 (<0.01) |
| Attitude | 2.43 (0.91) | 0.58 (<0.01) |
| Subjective norm | 2.30 (1.34) | 0.10 (0.14) |
| Descriptive norm | 2.64 (1.37) | 0.57 (<0.01) |
| Social pressure | 1.46 (0.76) | 0.13 (0.07) |
| Skills | 4.24 (1.11) | -0.10 (0.18) |
| Self-efficacy | 4.50 (0.90) | -0.36 (<0.01) |
| Habit | 1.71 (1.05) | 0.80 (<0.01) |

Significant correlations are in bold.

Scale 1 (totally disagree) – 5 (totally agree).

Appendix II

Appendix 2: Exact values for means of determinants and correlations with intention to reduce or quit cannabis use among cannabis users (N = 57).

| | Means (SD) | Correlations (R) with intention to use cannabis (p-value) |
|------------------|-------------|---|
| Risk perception | 2.61 (0.89) | 0.40 (0.03) |
| Attitude | 3.22 (0.71) | -0.54 (<0.01) |
| Subjective norm | 2.67 (1.41) | -0.21 (0.12) |
| Descriptive norm | 4.07 (0.75) | -0.17 (0.22) |
| Social pressure | 1.57 (0.78) | -0.07 (0.63) |
| Skills | 3.85 (1.13) | 0.01 (0.94) |
| Self-efficacy | 3.91 (1.19) | 0.14 (0.33) |
| Habit | 2.91 (1.17) | -0.63 (<0.01) |

Significant correlations are in bold.

Scale 1 (totally disagree) – 5 (totally agree).

Additional File

The additional file for this article can be found as follows:

- **S File.** Replication package. DOI: <https://doi.org/10.5334/hpb.18.s1>

Competing Interests

The authors have no competing interests to declare.

References

- Ajzen, I.** (1985). From Intentions to Actions: A Theory of Planned Behavior. In J. Kuhl & J. Beckmann (Eds.), *Action Control*. SSSP Springer Series in Social Psychology. Berlin, Heidelberg: Springer. DOI: https://doi.org/10.1007/978-3-642-69746-3_2
- Bartholomew, E. L. K., Markham, C. M., Ruiter, R. A. C., Fernandez, M. E., Kok, G., & Parcel, G. S.** (2016). Planning Health Promotion Programs: An Intervention Mapping Approach. 4th ed. San Francisco, CA: Jossey-Bass.
- Copeland, J., & Swift, W.** (2009). Cannabis use disorder: Epidemiology and management. *International Review of Psychiatry*, 21(3), 96–103. DOI: <https://doi.org/10.1080/09540260902782745>
- Crutzen, R., Peters, G. J. Y., & Noijen, J.** (2017). Using Confidence Interval-Based Estimation of Relevance to select social-cognitive determinants for behaviour change interventions. *Frontiers in Public Health*, 5, 165. DOI: <https://doi.org/10.3389/fpubh.2017.00165>
- D'Amico, E. J., & McCarthy, D. M.** (2006). Escalation and initiation of younger adolescents' substance use: The impact of perceived peer use. *Journal of Adolescent Health*, 39(4), 481–487. DOI: <https://doi.org/10.1016/j.jadohealth.2006.02.010>
- Fischer, B., Rehm, J., & Hall, W.** (2009). Cannabis use in Canada: the need for a Public-Health approach. *Canadian Journal of Public Health*, 100(2), 100–103. PMID: 19839283. DOI: <https://doi.org/10.1007/BF03405515>
- Grund, J. P., & Brecksema, J.** (2013). *Coffee Shops and Compromise. Separated Illicit Drug Markets in the Netherlands*. New York: Open Society Foundations.
- Horwood, L., Fergusson, D., Hayatbakhsh, M., Najman, J., Coffey, C., Patton, G., Sillins, E., & Hutchinson, D.** (2010). Cannabis use and educational achievement: Findings from three Australian cohort studies. *Drug and Alcohol Dependence*, 110, 247–253. DOI: <https://doi.org/10.1016/j.drugalcdep.2010.03.008>
- Hyman, S. M., & Sinha, R.** (2008). Stress-Related Factors in Cannabis Use and Misuse: Implications for Prevention and Treatment. *Journal of Substance Abuse Treatment*, 36(4), 400–413. DOI: <https://doi.org/10.1016/j.jsat.2008.08.005>
- Ito, T. A., Henry, E. A., Cordova, K. A., & Bryan, A. D.** (2015). Testing an expanded theory of planned behavior model to explain marijuana use among emerging adults in a promarijuana community. *Psychology of addictive behaviors: Journal of the Society of Psychologists in Addictive Behaviors*, 29(3), 576–89. DOI: <https://doi.org/10.1037/adb0000098>
- Latham, G. P., & Locke, E. A.** (2007). New development in and directions for goal-setting research. *European Psychologist*, 12, 290–300. DOI: <https://doi.org/10.1027/1016-9040.12.4.290>
- Lee, C. M., Neighbors, C., & Woods, B. A.** (2006). Marijuana motives: young adults' reasons for using marijuana. *Addictive behaviors*, 32(7), 1384–94. DOI: <https://doi.org/10.1016/j.addbeh.2006.09.010>
- Macleod, J., Oakes, R., Copello, A., Crome, I., Egger, M., Hickman, M., ... Davey Smith, G.** (2004). Psychological and social sequelae of cannabis and other illicit drug use by young people: A systematic review of longitudinal, general population studies. *Lancet*, 363(9421), 1579–1588. DOI: [https://doi.org/10.1016/S0140-6736\(04\)16200-4](https://doi.org/10.1016/S0140-6736(04)16200-4)
- Malmberg, M., Overbeek, G., Vermulst, A. A., Monshouwer, K., Vollebergh, W. A. M., & Engels, R. C. M. E.** (2011). The theory of planned behaviour: Precursors of marijuana use in early adolescence? *Drug and Alcohol Dependence*, 123(1–3), 22–28. DOI: <https://doi.org/10.1016/j.drugalcdep.2011.10.011>
- Moinester, M., & Gottfried, R.** (2014). Sample size estimation for correlations with pre-specified confidence interval. *The Quantitative Methods for Psychology*, 10(2), 124–130. DOI: <https://doi.org/10.20982/tqmp.10.2.p0124>
- Moore, T. H., Zammit, S., Lingford-Hughes, A., Barnes, T. R., Jones, P. B., Burke, M., & Lewis, G.** (2007). Cannabis use and risk of psychotic or affective mental health outcomes: A systematic review. *Lancet*, 370(9584), 319–328. DOI: [https://doi.org/10.1016/S0140-6736\(07\)61162-3](https://doi.org/10.1016/S0140-6736(07)61162-3)
- Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V.** (2008). Normative social

- influence is underdetected. *Personality Social Psychology Bulletin*, 34(7), 913–923. DOI: <https://doi.org/10.1177/0146167208316691>
- O’Keefe, D. J., & Jensen, J. D.** (2007). The relative persuasiveness of gain-framed and loss-framed messages for encouraging disease prevention behaviors: A meta-analytic review. *Journal of Health Communication*, 12(7), 623–644. DOI: <https://doi.org/10.1080/10810730701615198>
- Orbell, S.** (2013). Habit Strenth. In M. D. Gellman & J. R. Turner (Eds.), *Encyclopedia of Behavioral Medicine*. New York: Springer. DOI: https://doi.org/10.1007/978-1-4419-1005-9_1695
- Peters, G.-J. Y., & Crutzen, R.** (2018). Establishing determinant importance using CIBER: An introduction and tutorial. *The European Health Psychologist*, 20, 484–494. DOI: <https://doi.org/10.31234/osf.io/5wjy4>
- Peters, G.-J. Y., Ruiers, R. A. C., & Kok, G.** (2013). Threatening communication: A critical re-analysis and a revised meta-analytic test of fear appeal theory. *Health Psychology Review*, 7(Suppl 1), S8–S31. DOI: <https://doi.org/10.1080/17437199.2012.703527>
- Petty, R. E., Barden, J., & Wheeler, S. C.** (2009). The Elaboration Likelihood Model of Persuasion: Developing health promotions for sustained behavioral change. In R. J. DiClemente, R. A. Crosby & M. Kegler (Eds.), *Emerging theories in heath promotion practice and research* (2nd ed., pp. 185–214). San Fransisco: Jossey-Bass.
- Prochaska, J. O., Redding, C. A., & Evers, K. E.** (2015). The Transtheoretical Model and stages of change. In K. Glanz, B. K. Rimer & K. Viswanath (Eds.), *Health behavior: Theory, research, and practice* (pp. 125–148). San Francisco: Jossey-Bass.
- Roscoät, D., Cordogan, C., Guignard, R., Wilguin, J., & Beck, F.** (2015). Determinants of the intention to abstain from or reduce alcohol, tobacco or cannabis use among 15–25 year-olds. *Sante Publique*, 27(5), 641–651. DOI: <https://doi.org/10.3917/spub.155.0641>
- Scull, T., Kupersmidt, J., Parker, A., Elmore, K., & Benson, J.** (2010). Adolescents’ media-related cognitions and substance use in the context of parental and peer influences. *Journal of Youth and Adolescence*, 39, 981–998. DOI: <https://doi.org/10.1007/s10964-009-9455-3>
- Sillins, E., Horwood, J., Patton, G., Fergusson, D., Olsson, C., & Hutchinson, D.** (2014). Young adult sequelae of adolescent cannabis use: An integrative analysis. *Lancet Psychiatry*, 1, 286–293. DOI: [https://doi.org/10.1016/S2215-0366\(14\)70307-4](https://doi.org/10.1016/S2215-0366(14)70307-4)
- Simons, J. S., & Arens, A. M.** (2007). Moderating effects of sensitivity to punishment and sensitivity to reward on associations between marijuana effect expectancies and use. *Psychological Addiction Behaviour*, 21(3), 409–414. DOI: <https://doi.org/10.1037/0893-164X.21.3.409>
- Solowij, N.** (2010). Commentaries on Macleod & Hickman, Harms to body and soul – an ideological balancing act for preventing and reducing cannabis use. *Addiction*, 105, 1331–1332. DOI: <https://doi.org/10.1111/j.1360-0443.2010.02923.x>
- Sussman, S., Stacy, A. W., Dent, C. W., Simon, T. R., & Anderson Johnson, C.** (1996). Marijuana Use: Current Issues and New Research Directions. *Journal of Drug Issues*, 26(4), 695–733. DOI: <https://doi.org/10.1177/002204269602600402>
- Tsering, D., & Pal, R.** (2009). Role of Family and Peers in Initiation and Continuation of Substance Use. *Indian Journal of Psychological Medicine*, 31(1), 30–34. DOI: <https://doi.org/10.4103/0253-7176.53312>
- Van Bokhorst, L. G., Kraag, G., Dupont, H., & Kok, G.** (2017). ‘What you think is what you drink’: De invloed van sociale normen op alcoholconsumptie. *Verslaving*. DOI: <https://doi.org/10.1007/s12501-017-0109-y>
- Van Laar, M. W., & Ooyen-Houben, M. M. J.** (2016). Nationale Drug Monitor. Retrieved from <https://assets.trimbos.nl/docs/3fdeab39-f34e-4aa0-97af-5dbf111c05a0.pdf>
- Walker, D., Neighbors, C., Rodriguez, L., Stephens, R., & Roffman, R.** (2011). Social norms and self-efficacy among heavy using adolescent marijuana smokers. *Psychology of Addictive Behaviours*, 25(4), 727–732. DOI: <https://doi.org/10.1037/a0024958>
- Wood, W., & Neal, D. T.** (2007). A new look at habits and the habit-goal interface. *Psychological Review*, 144(4), 843–863. DOI: <https://doi.org/10.1037/0033-295X.114.4.843>

Peer Review Comments

Health Psychology Bulletin has blind peer review, which is unblinded upon article acceptance. The editorial history of this article can be downloaded here:

- **PR File 1.** Peer Review History. DOI: <https://doi.org/10.5334/hpb.18.pr1>

How to cite this article: Evers, Y. J., Dupont, H. B., Crutzen, R., & Heuperman, P. (2020). Using the Confidence Interval-Based Estimation of Relevance Approach to Identify Determinants of Cannabis Use among High School Students in the Netherlands. *Health Psychology Bulletin*, 4(1), 10–17. DOI: <https://doi.org/10.5334/hpb.18>

Submitted: 19 June 2018

Accepted: 27 June 2019

Published: 18 March 2020

Copyright: © 2020 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.



Health Psychology Bulletin is a peer-reviewed open access journal published by Ubiquity Press.

OPEN ACCESS