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# Public knowledge, perceptions, and behavioral intention regarding medical cannabis in Belgium

Matthias Pav[1,2], Geert Haesaert[2], Hans De Steur[1*]

[1] Division of Agri-Food Marketing and Chain Management, Faculty of Bioscience Engineering, Ghent University, Belgium

[2] Department of Plants and Crops, Faculty of Bioscience Engineering, Ghent University, Belgium

*corresponding author: hans.desteur@ugent.be; +32 (0)9 264 59 30

**Abstract**

Growing evidence on medical cannabis has moved its legislation forward in various countries, which has increased research on stakeholder reactions. While various studies looked at experts and users, research on public perceptions is scarce. This study aims to (1) examine the relationships between knowledge, perceptions, and behavioral intention toward medical cannabis, and (2) identify and profile key segments within the general public. An online survey was conducted among 656 respondents in Belgium. Findings showed that both subjective and objective knowledge are relatively poor, while risk/benefit perceptions and behavioral intention are much more positive. Subjective and objective knowledge as well as social trust have a negative influence on risk perceptions and a positive influence on benefit perceptions. In turn, risk and benefit perceptions are key determinants of behavioral intention, but in opposite directions. Furthermore, cluster analysis identified a cautious (23% of the sample), positive (50%), and enthusiastic cluster (27%). In terms of socio-demographic profile, older and highly educated people were significantly more represented in the latter two clusters. While our study demonstrated that cannabis is well accepted for medical purposes, research is needed to further validate the relationships between knowledge, perceptions, and (intended) behavior in different settings and policy contexts.

**Keywords**: behavioral intention, knowledge, medical cannabis, perceptions, survey, Belgium.

## Introduction

*Cannabis* exhibits genetic and phenotypic diversity and is a multipurpose plant with a variety of uses, including food, fiber, construction materials, paper, and biofuel, and has various pharmacological properties that can be absorbed by the body through different forms (e.g., vaporizers, joints, edibles, smoothies, capsules, sprays, tinctures and ointments (Clarke & Merlin 2016). Cannabis for medical purposes has gained increasing interest (Manthey 2019; Pratt et al. 2019; Treister-Goltzman et al. 2019), resulting in a variety of therapeutic products based on single or multiple cannabinoids (e.g., Cannabidiol (CBD), tetrahydrocannabinol (THC)). While more evidence on its health benefits is needed (Pratt et al. 2019), changes in legislation have facilitated the introduction and use of medical cannabis in the United States, Canada, Germany and many other countries (Hall 2022; Treister-Goltzman et al. 2019). In Europe, for instance, medical cannabis is cultivated for commercial purposes in fifteen countries, with more than 300,000 patients estimated to have access to medical cannabis products (Prohibition partners 2022).

Despite regulatory challenges, the market of CBD products is growing rapidly (Manthey 2019). In line with the increasing number of technical publications (Treister-Goltzman et al. 2019) and the commercialization of medical cannabis (Manthey 2019), there is a growing body of literature on stakeholder evaluation of medical cannabis. Most of these studies have targeted users or patients (Arora et al. 2020; Banwell et al. 2016; Bawin 2020; Manning & Bouchard 2021), as well as experts, such as pharmacists (Reece, Holle & Mukherjee 2021; Szaflarski et al. 2020; Szyliowicz & Hilsenrath 2019), nurses (Sokratous et al. 2021; Szaflarski et al. 2020), physicians (Arnfinsen & Kisa 2021; Kaplan et al. 2020; Ng et al. 2021; Szaflarski et al. 2020; Takakuwa et al. 2021), or students in social work (Findley et al. 2021) or other health-related expert fields (Bonnici & Clark 2021; Caligiuri, Ulrich & Welter 2018; Khamenka & Pikirenia 2021; Pierre, Matthews & Walsh 2020). A few studies have also targeted the general public, such as the study of Gazibara, et al. (2017) in Serbia, and the study by Gates

et al. (2017) in Australia. This highlights the need for more research on laypersons' views on medical cannabis.

When looking at the current literature in stakeholder research on medical cannabis, the focus was mainly on assessing knowledge, perceptions, or general attitudes. Findings generally indicated low subjective, self-reported knowledge, even among health care professionals (Szaflarski et al. 2020; Szyliowicz & Hilsenrath 2019) and students (Moeller, McGuire & Melton 2020; Moeller & Woods 2015). Objective knowledge about medical cannabis was low, not only among experts (Reece, Holle & Mukherjee 2021; Szaflarski et al. 2020) and students in health care (Caligiuri, Ulrich & Welter 2018; Moeller, McGuire & Melton 2020; Pierre, Matthews & Walsh 2020; Sokratous et al. 2021), but also among the general public (Gates, Todd & Copeland 2017). Nevertheless, studies with experts (Arnfinsen & Kisa 2021; Kaplan et al. 2020; Szaflarski et al. 2020), students (Moeller & Woods 2015), medical cannabis users (Arora et al. 2020; Henriquez & Hamilton 2019; Luque et al. 2021; Magnan & Ladd 2019), as well as the general public (Gazibara et al. 2017) reported positive perceptions and attitudes toward medical cannabis. In some studies, higher perceived benefits were associated with lower risk perceptions (Jacobs, Kane & Caballero 2022; Shorey Fennell et al. 2022).

While the role of cognitive (e.g., knowledge) and attitudinal factors (e.g., benefit and risk perceptions) as determinants of behavioral intention for healthy (De Steur et al. 2014; Mogendi et al. 2016), environmentally friendly (Onwezen et al. 2020), and innovative products (Kamrath et al. 2019) has been demonstrated, few studies have examined the relationships between knowledge, perceptions, and behavior related to medical cannabis (McKelvey et al. 2021; Salloum et al. 2018; Szaflarski et al. 2020). However, at the level of the general public, behavioral intentions related to the use or purchase of medical cannabis and their determinants have not yet been examined.

Furthermore, because stakeholder research on medical cannabis has mostly examined specific populations (e.g., medical students), little research has examined attitudinal differences according to socio-demographic characteristics. In a study with older adults (Arora et al. 2020), for instance, the oldest respondents had a stronger negative attitude toward medical cannabis. Student-oriented studies reported differences according to region (Konstantinov et al. 2021) and gender (Felnhofer et al. 2021; Sobczynski et al. 2013), with more positive perceptions of male students. As for the public level, socio-demographic profiling is still scarce.

To address this knowledge gaps, this study targets the general public and aims to (1) examine the relationships between public knowledge, perceptions, and behavioral intention regarding medical cannabis, and (2) identify and profile key segments of laypersons based on socio-demographic variables. This study is conducted in Belgium and complements past research concerning medical cannabis users (Bawin 2020). Belgium adheres to the 1999 European law that sets a threshold of 0.2% of THC content as a criterion for *Cannabis* cultivars that can be legally cultivated with a license (FAMPH 2021; FPS Health Food Chain Safety and Environment 2022; Kruse 2016). Although adult possession and/or use of cannabis is given the lowest priority for law enforcement, cannabis and cannabis products containing more than 0.2% THC are prohibited. However, as long as medical cannabis products have a THC value below 0.2% and are not promoted as a consumer product, they may be legally traded in Belgium (Kruse 2016). For example, it is possible to sell dried cannabis flowers for ornamental purposes or, under certain conditions, as a smokable product (FAMPH 2021; FPS Health Food Chain Safety and Environment 2022). In addition, Belgian pharmacies may dispense medicines based on cannabis (cannabinoids) by medical prescription (e.g. *Sativex*®)(FAMPH 2021). To date, no nutritional supplement containing CBD received authorization in Belgium. This makes it a relevant study location to investigate behavioral intentions toward medical cannabis products.

## Methods

*Participants and procedures*

This study is based on an online survey targeting the general public in Belgium. Only Belgian adult residents who speak French or Dutch were eligible to participate. Pre-testing of the online survey was done with laypersons in both language regions, as well as with experts from the Faculty of Criminology and the Faculty of Bioscience Engineering. As the target audience was laypersons, special care was taken to simplify technical terminology in this survey. Sampling was based on convenience. We distributed our final survey across personal and institutional social media channels (e.g., Facebook and Instagram) in April-May 2020. For each channel, one reminder was sent after ~4 weeks. This included a short message to briefly explain the survey and the approximate time needed (about 15 minutes), and the anonymous nature of data collection, analysis, and reporting. All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees and with the Helsinki Declaration of 1975, as revised in 2008, the EU General Data Protection Regulation 2016/679 and the 2018 EU guidelines on Ethics in Social Science and Humanities. Participants were adult volunteers who were informed about the overall purpose of the study, provided informed consent to participate, and were free to withdraw at any time. Participants were informed about the contact details of the principal researcher and the institutional Data Protection Officer of the University to be contacted in case of queries. No personally identifiable data were recorded and data records were anonymized for storage and further analysis. Of the 821 people who responded to the survey, 166 respondents (20.2%) were removed due to incomplete responses, resulting in a final dataset of 656 respondents.

*Instrument*

A standardized online survey was developed in Qualtrics (Provo, UT, USA), both in Dutch and French languages. The first section dealt with the socio-demographic profile of respondents:

age (in years), gender (male/female), education level (low/high; with university of applied sciences and university as “high”), having children (yes/no), and region (Flanders/Wallonia). The next sections measured the constructs of knowledge (subjective, objective), perceptions (risk, benefit, social trust), and behavioral intention. All underlying statements were derived from the literature and validated through confirmatory factor analysis (see below). Both subjective and objective knowledge of medical cannabis were assessed. While it is recommended to distinguish between both types of knowledge (Carlson et al. 2009), only a few (expert) studies measured these simultaneously (Szaflarski et al. 2020). Here, subjective knowledge determines whether or not someone had any previous knowledge about cannabis. This construct was measured by four statements, each based on a 7-point scale (1=no knowledge, to 7=a lot of knowledge)(Moeller & Woods 2015; Szyliowicz & Hilsenrath 2019). These statements referred to knowledge about medical cannabis, its risks and benefits, the different types of products, and the Belgian legislation. In line with research on public perceptions of consumer goods (De Steur et al. 2014; Faber et al. 2020; Park et al. 2020), objective knowledge of medical cannabis was measured using 10 true-or-false statements (including an “I don’t know” category) on medical cannabis (3 statements), its legal framework (3 statements), and evidence of its effects (4 statements). While knowledge questions in expert surveys have been phrased in various ways (Gates, Todd & Copeland 2017; Moeller, McGuire & Melton 2020; Szaflarski et al. 2020; Szyliowicz & Hilsenrath 2019; Takakuwa et al. 2021), and are typically based on expert-oriented terminology, we included a set of simplified questions to measure objective knowledge at public level. Wording of these statements was based on an review of the medical literature on cannabis, refined in consultation with cannabis experts from the Department of Criminology (Bawin 2020), and pre-tested with laypersons as well as botanists, agricultural engineers and criminologists at Ghent University. Following these knowledge statements, a brief, neutral information statement explained medical cannabis, its forms, and current regulation in Belgium (Cerino et al. 2021; FAMPH 2021):

“Medical cannabis is cannabis in all forms derived from the plant of the genus *Cannabis* and intended for use as a medicine and/or for the relief of health complaints. As long as medical cannabis products are not presented or promoted as a consumable and the THC value (the psychoactive component of cannabis) of these products does not exceed 0.2%, they may be legally traded in Belgium (translated from Dutch)”. Thereby, different forms were shown, including vaporizers, joints, edibles, smoothies, tea and salads that contain fresh cannabis flowers or leaves, capsules, sprays, tinctures and ointments. The information statement was provided after the objective and subjective knowledge questions to avoid influencing respondents’ knowledge. Respondents then rated social trust (4 statements)(Connor & Siegrist 2010), benefits perceptions (4 statements)(Philpot, Ebbert & Hurt 2019; Siegrist 2000), risk perceptions (3 statements)(Siegrist 2000), and behavioral intention (3 statements)(Vanhonacker et al. 2013). Social trust is associated with trust in the institutions that deal with the production, distribution, and regulation, and has not been measured in medical cannabis research. Each statement was based on a 5-point Likert scale (1=strongly agree, to 5=strongly disagree).

*Data analysis*

The data were exported from Qualtrics to STATA for analysis. For objective knowledge, all true-or-false statements were recoded into dummy variables (correct/incorrect) and combined into a single index (% correct answers). One item (SocTrust4) was reverse-coded. Descriptive statistics were used to analyze the frequency distributions of the socio-demographic variables and calculate the mean and standard deviation of the survey constructs.

To analyze the relationships between the constructs related to knowledge, perceptions, and behavioral intention regarding medical cannabis, covariance-based Structural Equation Modelling (SEM) with maximum likelihood estimation was performed. This technique includes confirmatory factor analysis of the measurement model and path analysis of the structural

model. First, the measurement model was computed by confirmatory factor analysis to produce factor loadings that determined how items (i.e. statements) represented their respective construct. Items with low factor loadings (< 0.5) were removed from analysis. Based on the factor loadings of the measurement model, the Average Variance Extracted (AVE) and composite reliability (CR) were calculated. The measurement model is evaluated in terms of construct reliability, convergent and discriminant validity, and goodness of fit. Regarding construct reliability, the internal consistency and reliability of the constructs were estimated using Cronbach's alpha and CR, respectively, with 0.7 as the minimum satisfactory value (Hair 2009). Convergent validity of the different constructs was evaluated based on the AVE, with values preferred to be 0.5 or higher. Pearson bivariate correlation coefficients between constructs were compared with the square root of AVE to determine discriminant validity. Thereby, AVE values of each construct should exceed the squared correlation. The appropriateness of the model was assessed using the following goodness-of-fit indices: chi²-value ($\chi^2$), $\chi^2$/df ratio, Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), Comparative Fit Index (CFI) and Tucker Lewis Index (TLI). Following the thresholds specified by Hair et al. (2009), the overall model fit is considered satisfactory if CFI and TLI are higher than 0.92, SRMR is lower than 0.8, and RMSEA is lower than 0.07. Given our large dataset, the chi²-value is expected to be significant, with chi²/df greater than 2.

Second, the structural model was developed. Based on previous literature in consumer research (De Steur et al. 2014; Kamrath et al. 2019; Mogendi et al. 2016; Onwezen et al. 2020), the following relationships were estimated: Subjective and objective knowledge, which are assumed to covary, are hypothesized to influence social trust; both types of knowledge and social trust are expected to influence the benefit and risk perceptions, which are assumed to covary; and social trust, as well as benefit and risk perceptions, are expected to influence behavioral intention. Figure 1 presents the final structural model to analyze the relationships

between the different constructs. Goodness-of-fit indices, as well as the modification indices, were reviewed to evaluate and improve the structural model. A satisfactory structural model will then be used to evaluate the relationships between the constructs, the path coefficients, and explained variance.

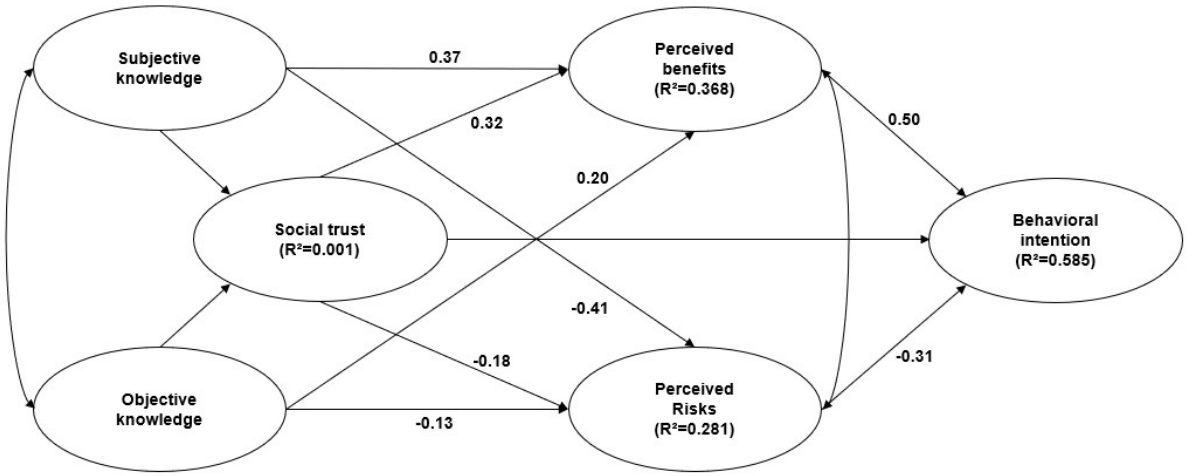


**Figure 1.** Structural model of the relationships between knowledge (subjective and objective), attitude (social trust, perceived benefits and risks), and behavioral intention related to medical cannabis. Significant, standardized path coefficients.
Note: Goodness-of-fit statistics: Chi-square (107) = 288.220, $p < 0.001$; chi-square/df. = 2.69; RMSEA = 0.051; SRMR = 0.035; CFI = 0.972; TLI = 0.964.

To identify homogeneous segments or clusters in the sample, hierarchical cluster analysis was performed, using Ward's cluster method with squared Euclidean distances. All constructs were inserted as cluster variables. Therefore, a summated scale was developed for each construct based on the final SEM model. Identified clusters were then further profiled. First, cluster differences in knowledge, perceptions, and behavioral intention were examined by One-way ANOVA. Second, a multinomial logistic regression analysis was performed with socio-demographic variables (age, gender, education, having children, and region) as independent, dummy variables, and cluster membership as the categorical, dependent variable. This analysis makes it possible to classify respondents based on values of a set of socio-

demographic variables, while using one of the clusters as a benchmark category. Results are presented as odds ratios to demonstrate the change in odds with a one-unit change in the explanatory variable.

## Results

Of 656 respondents nearly 60% are male and 56% have children (see supplementary Table 1). The majority is highly educated (60%) and lives in the Flemish region (Dutch-speaking; 80%). Nevertheless, the large sample size allows all socio-demographic variables to be included in the analysis to profile the clusters.

### *Knowledge, perceptions, and behavioral intention*

Overall, subjective knowledge of medical cannabis is low, especially with respect to legislation (Table 1). The standard deviations point to heterogeneity in what respondents think to know, but the overall tendency leans toward the lower end of the 7-point scale. In terms of objectively assessed knowledge, about half of the true-false statements were answered correctly (54%). The degree of correctness varies substantially between statements, from 24% (“Medical cannabis is effective against color blindness”)(false) to 83% correct responses (“You will always get high from medical cannabis”)(false). We note that many respondents opted for the “I don’t know” category, from 12% to 69%, with an average of 28% across the statements. This confirms the overall lack of objective knowledge. Furthermore, objective and subjective knowledge (summated scale) are significantly and positively correlated. In general, the more a respondent state to know what medical cannabis is, the higher the objective knowledge score.

**Table 1.** Subjective and objective knowledge of medical cannabis. Descriptives of the summated scales and the underlying statements (n = 656)

| **Variables/statements** | **Mean ± SD** | |
|---|---|---|
| **Subjective knowledge of medical cannabis** | **3.50 ± 1.50** | |
| SubjKnow1. Medical cannabis | 3.71 ± 1.55 | |
| SubjKnow2. The risks and benefits of medical cannabis | 3.67 ± 1.61 | |
| SubjKnow3. The different types of medical cannabis products | 3.54 ± 1.72 | |
| SubjKnow4. The legislation on medical cannabis | 3.08 ± 1.63 | |
| **Objective knowledge of medical cannabis (% correct)** | **53.9 ± 22.5** | |
| | **% incorrect** | **% correct** |
| Medical cannabis can only be administered via oil *(false)* | 29.1 | 70.7 |
| CBD is a type of cannabis plant *(false)* | 35.4 | 64.6 |
| The main psychoactive component in cannabis is HTC *(false)* | 59.3 | 40.7 |
| Medical cannabis comes from the male cannabis plant *(false)* | 53.5 | 46.5 |
| Dried medical cannabis (weed) can be obtained in a Belgian pharmacy *(false)* | 45.9 | 54.1 |
| Possession of a cannabis plant for personal use is illegal in Belgium *(true)* | 68.4 | 31.6 |
| Cannabis (hemp) can currently be legally grown as an agricultural crop in Belgium *(true)* | 62.5 | 37.5 |
| Medical cannabis is effective against color blindness *(false)* | 75.8 | 24.2 |
| You will always get high from medical cannabis use *(false)* | 17.4 | 82.6 |
| Medical cannabis can be effective against pain and epilepsy *(true)* | 13.1 | 86.9 |
| **Correlation** | **r** | **p-value** |
| Subjective - Objective knowledge | 0.623 | <0.001 |

CBD, cannabidiol; r, correlation coefficient; SD, standard deviation

Note: Subjective knowledge items are measured on a 7-point scale. Objective knowledge statements are presented according to topic (general, legal framework, effect). Total score of objective knowledge is based on the average score of the ten underlying items.

Table 2 summarizes the mean and standard deviation of each attitude construct (social trust, perceptions of the risks and benefits, behavioral intention) and their underlying statements. Despite the variation between and within statements, public reactions toward medical cannabis are generally positive. Regarding social trust, awareness of producers' responsibilities as well as monitoring have the lowest mean, though close to the neutral midpoint. Health and societal benefits are broadly acknowledged by the respondents, while public approval of environmental benefits is substantially lower. Scores on risk perceptions are below the midpoint, indicating a slight tendency toward disagreement. Finally, the behavioral intention is rather positive. Under the assumption that someone would need medical cannabis, the average respondent is

(highly) willing to try, consume and purchase medical cannabis. This is especially the case if the health benefits, much more than environmental benefits, would be larger than those of the alternatives (see footnote of Table 2).

**Table 2.** Descriptives of social trust, benefit and risk perceptions, and behavioral intention (n = 656)

| Variable | Description | Mean | SD |
|---|---|---|---|
| SocTrust1 | I trust that the label of a medical cannabis product will accurately describe its actual content. | 4.18 | 0.98 |
| SocTrust2 | I trust that medical cannabis can be properly controlled by appropriate legislation. | 4.20 | 0.98 |
| SocTrust3 | Producers involved in medical cannabis are aware of their responsibilities. | 3.88 | 1.04 |
| SocTrust4 (R) (removed) | Authorities are not sufficiently able to monitor whether the producers of medical cannabis comply with the legislation. | 2.99 | 1.20 |
| PercBenef1 | Medical cannabis can help treat symptoms associated with medical conditions. | 4.55 | 0.65 |
| PercBenef2 (removed) | The medical cannabis sector is more environmentally friendly than the regular pharmaceutical sector. | 3.72 | 0.99 |
| PercBenef3 | Medical cannabis can improve people's quality of life. | 4.46 | 0.75 |
| PercBenef4 | Considering all aspects, our society benefits from medical cannabis. | 4.30 | 0.92 |
| PercRisk1 | Medical cannabis use can lead to addiction. | 2.59 | 1.18 |
| PercRisk2 | Medical cannabis products could be dangerous for the society. | 1.98 | 1.04 |
| PercRisk3 | There are still unknown risks associated with medical cannabis use. | 2.79 | 1.11 |
| BehavIntent1 | I have no problem with consuming medication that contains cannabis. | 4.56 | 0.80 |
| BehavIntent2 | I would be willing to try medical cannabis. | 4.29 | 1.10 |
| BehavIntent3 | I would be interested in buying medical cannabis. | 3.97 | 1.27 |
| SOCTRUST | Summated scale of social trust | 4.09 | 0.82 |
| PERCBENEF | Summated scale of perceived benefits | 4.44 | 0.65 |
| PERCRISK | Summated scale of perceived risks | 2.45 | 0.91 |
| BEHAVINTENT | Summated scale of behavioral intention | 4.27 | 0.92 |

(R), reverse coded; SD, standard deviation

Note: 2 items (SocTrust4, PercBenef2) were removed after evaluating the initial measurement model (see Supplementary Table 2). Two additional statements related to behavioral intention, i.e. “If medical cannabis would be healthier than the alternatives, I would consider buying it” ($\bar{x}$=4.53 ±0.87) and “I would pay more for a cannabis-based drug if it would reduce my carbon footprint” ($\bar{x}$=3.74±1.26) (not shown in the table), were excluded as they conceptually differ from the three behavioral intention statements.

*Relationships between knowledge, perceptions, and behavioral intention*

This section first describes the evaluation of each step of the SEM analysis, i.e. confirmatory factor analysis and path analysis, after which the findings related to the relationships in our model (path coefficients) are presented.

Based on confirmatory factor analysis, two indicators with low factor loadings (< 0.5) were removed from analyses: socialtrust4 (on social monitoring); PercBenef2 (on environmental benefits). After removing these items, all individual item loadings of the improved measurement model are highly significant ($p<0.001$) and exceed the 0.5 threshold (Supplementary Table 2). Consequently, the improved model consists of one 4-item (subjective knowledge) and four 3-item constructs (social trust, perceived risks, perceived benefits, behavioral intention).

The improved measurement model is evaluated in terms of reliability, validity, and goodness of fit (Supplementary Table 2). All Cronbach's alpha and CR values exceed the minimum satisfactory value of 0.7 (Hair 2009), indicating construct reliability. The AVE values for each construct are also satisfactory (>0.5) and, together with the CR values, provide strong indications of convergent validity. AVE values of the constructs are also larger than the squared correlation between the respective constructs, indicating discriminant validity. The overall fit of the model is considered satisfactory, with CFI and TLI higher than 0.92, SRMR lower than 0.8, and RMSEA lower than 0.07. As expected based on our large dataset, the $chi^2$-value is significant, and the $chi^2/df$ was larger than 2.

The second step of the SEM consists of the estimation of the structural model. Goodness-of-fit statistics are again within the acceptable range: Chi-square (107) = 288.220, $p < 0.001$; chi-square/df. = 2.69; RMSEA = 0.051; SRMR = 0.035; CFI = 0.972; TLI = 0.964. Based on the analysis of the modification indices, the covariance between the correlated constructs of perceived benefits and risks ($r=-0.523$, $p<0.001$), and subjective and objective knowledge

(r=0.623, p<0.001) was added to the model. The final structural model is then used for estimating the path coefficients (see Figure 1).

Table 3 summarizes the direct relationships between subjective and objective knowledge, social trust, risk and benefit perceptions, and behavioral intention. Findings demonstrate that subjective and objective knowledge do not significantly influence social trust, but both types of knowledge have a negative and positive influence on, respectively, perceived risks and perceived benefits. While both types of knowledge covary significantly, much larger coefficients are obtained for subjective knowledge. A similar influence on both benefit and risk perceptions is found for social trust, though with a smaller coefficient than for subjective knowledge. In sum, the higher the degree of subjective/objective knowledge and social trust, the more positive the perceptions of the benefits and risks of medical cannabis. The latter two concepts covary significantly and are both strongly linked to behavioral intention, with perceived benefits as the strongest determinant. Social trust did not appear to be important as a determinant of behavioral intention. Overall, the effect of the significant determinants is the largest for subjective knowledge and perceived benefits. When looking at the dependent variables, the variance explained by the independent variables varies between 28.1% to 58.5%.

**Table 3.** Relationships between knowledge, attitudinal variables and behavioral intention (path analysis). Standardized path coefficients, significance and explained variance (n=656).

| Path Independent | → | Dependent | Standardized coefficients | p-value | $R^2$ ($mc^2$) |
|---|---|---|---|---|---|
| Subjective Knowledge | → | Social trust | -0.038 | 0.699 | 0.001 |
| Objective Knowledge | → | Social trust | 0.024 | 0.975 | |
| Subjective Knowledge | → | Perceived benefits | **0.368** | <0.001 | 0.368 |
| Objective Knowledge | → | Perceived benefits | **0.196** | <0.001 | |
| Social trust | → | Perceived benefits | **0.323** | <0.001 | |
| Subjective Knowledge | → | Perceived risks | **-0.405** | <0.001 | 0.281 |
| Objective Knowledge | → | Perceived risks | **-0.132** | <0.010 | |
| Social trust | → | Perceived risks | **-0.180** | <0.001 | |
| Social trust | → | Behavioral intention | 0.067 | 0.104 | 0.585 |
| Perceived benefits | → | Behavioral intention | **0.499** | <0.001 | |
| Perceived risks | → | Behavioral intention | **-0.305** | <0.001 | |

Note: Bold indicates significance at 0.01 level.

*Public segmentation*

Hierarchical cluster analysis identified three clusters, denoted as the “cautious” (23% of the sample), “positive” (50%), and “enthusiastic” clusters (27%) (see Table 4). The means of all cluster variables are significantly different between these clusters and were used to underpin the cluster names. The “cautious” cluster (cluster 1) has the lowest average scores on each of the knowledge and attitudinal variables, with mean values typically around the mid-point, or even lower in the case of subjective knowledge and intended behavior. Given these findings, and the significantly lower levels of behavioral intention, this group is depicted as being cautious. The “enthusiastic” cluster (cluster 3) is opposite to the cluster of cautious people and is characterized by significantly higher knowledge levels and very positive attitudes. People in this cluster also rate the cluster variables typically higher than those in the “positive” cluster (cluster 2). The latter holds the middle position and is positively oriented toward medical cannabis and its use, but significantly less than those in the enthusiastic cluster, except for social trust.

**Table 4.** Significant cluster differences in knowledge, social trust, perceptions and behavioral intention with respect to medicinal cannabis (segmentation analysis), by One-way Anova (n=656)

| | **Cluster 1. Cautious** | **Cluster 2. Positive** | **Cluster 3. Enthusiastic** | **Total sample** | |
|---|---|---|---|---|---|
| n (%) | 152 (23%) | 326 (50%) | 178 (27%) | 656 (100%) | |
| | **mean ± SD** | **mean ± SD** | **mean ± SD** | **mean ± SD** | **F-value** |
| Subjective knowledge | 2.60 ± 1.25 | 3.35 ± 1.36 | 4.53 ± 1.32 | 3.50 ± 1.50 | 90.532*** |
| Objective knowledge | 0.43 ± 0.25 | 0.54 ± 0.21 | 0.64 ± 0.19 | 0.54 ± 0.22 | 41.087*** |
| Social trust | 3.62 ± 0.96 | 4.30 ± 0.51 | 4.09 ± 0.97 | 4.09 ± 0.82 | 40.986*** |
| Perceived benefits | 3.68 ± 0.64 | 4.53 ± 0.49 | 4.92 ± 0.19 | 4.44 ± 0.65 | 297.762*** |
| Perceived risks | 3.42 ± 0.64 | 2.58 ± 0.58 | 1.39 ± 0.40 | 2.45 ± 0.92 | 570.739*** |
| Intended behavior | 3.13 ± 0.93 | 4.48 ± 0.65 | 4.87 ± 0.32 | 4.13 ± 0.95 | 316.909*** |

SD, standard deviation; *** $p < 0.001$.

Note: except for objective knowledge, all variables are composite variables, based on the average score of all statements, as included in our final SEM model. Except for objective (%) and subjective knowledge (1-7), all variables were measured on a 5-point Likert scale.

Multinomial logistic regression was performed to profile the clusters based on the socio-demographic characteristics. Multinomial logistic regression consists of three comparisons (binary logistic regressions), where one cluster is compared with another, i.e. reference category. As such, the impact of five socio-demographic variables on cluster membership is determined. Table 5 presents the odds ratios, confidence intervals, and significance levels for each explanatory variable. Goodness-of-fit statistics demonstrate an adequate model fit. The likelihood ratio test of the model ($\chi^2 = 80.573$; $p<0.001$) is significant, with a Nagelkerke Pseudo $R^2$ of 13.2%, and three significant determinants (age, education, region). A one-unit increase in age increases the odds to be in cluster 3. Older people are more likely to belong to the enthusiastic cluster. Education positively influences the likelihood to belong to the positive and enthusiastic clusters. Having a high education level lowers the odds to be cautious. Flemish people, who are relatively more represented in our sample, are more likely to be part of clusters 1 and 2. Gender and having children do not influence cluster membership.

**Table 5.** Socio-demographic profiling of clusters based on knowledge, attitude and behavioral intention regarding medicinal cannabis, by multinomial logistic regression (n=656).

| | **Cluster 2 vs Cluster 1[a] (Positive vs Cautious)** | | | **Cluster 3 vs Cluster 1[a] (Enthusiastic vs Cautious)** | | | **Cluster 3 vs Cluster 2[a] (Enthusiastic vs Positive)** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **OR** | **(95%CL)** | **p** | **OR** | **(95%CL)** | **p** | **OR** | **(95%CL)** | **p** |
| Age | 1.015 | (0.996-1.035) | 0.119 | **1.052** | **(1.030-1.074)** | **<0.001** | **1.036** | **(1.019-1.052)** | **<0.001** |
| Gender (woman[a]) | 0.939 | (0.629-1.402) | 0.757 | 0.956 | (0.598-1.527) | 0.850 | 1.018 | (0.689-1.505) | 0.928 |
| Education (low[a]) | **1.722** | **(1.138-2.606)** | **0.010** | **1.682** | (1.041-2.718) | **0.034** | 0.977 | (0.663-1.440) | 0.906 |
| Having children (no[a]) | 1.133 | (0.668-1.919) | 0.643 | 0.873 | (0.487-1.565) | 0.648 | 0.771 | (0.484-1.228) | 0.273 |
| Flemish region (Walloon[a]) | 0.935 | (0.594-1.470) | 0.770 | **0.384** | (0.204-0.723) | **0.003** | **0.410** | **(0.232-0.725)** | **0.002** |

OR, Odds ratio.

[a]Reference category

Note: Likelihood ratio test of the model: $\chi^2 = 80.573$ (p=0.001), Pseudo $R^2$: 0.132 (Nagelkerke). All factors are dummy variables, except for age (in years). Bold indicates significance at 0.05 level or below.

## Discussion

This study contributes to current research in different ways. First, it assesses knowledge and attitudes in a non-expert sample. Second, it uses SEM to determine associations between constructs to explain the formation of attitudes and behavioral intentions related to medical cannabis. Third, it goes beyond the few public-oriented studies (Gates, Todd & Copeland 2017; Gazibara et al. 2017) by clustering the sample according to their knowledge, attitudes, and behavioral intention, and profiling the clusters according to socio-demographic variables.

The findings demonstrate a positive attitude toward medical cannabis. A similar conclusion can be drawn from expert-oriented studies, by which the majority of health care professionals (Arnfinsen & Kisa 2021; Szaflarski et al. 2020; Szyliowicz & Hilsenrath 2019) and students in health care (Khamenka & Pikirenia 2021) or social work (Findley et al. 2021) were interested to recommend medical cannabis for patients. In our study, the associated health benefits are positively evaluated, while risk perceptions are generally low. Furthermore, the social trust levels are relatively high, indicating positive beliefs about regulation and monitoring, which contradicts the inaccurate labeling that often characterizes the unregulated, recreational cannabis industry (Bonn-Miller et al. 2017). However, the positive reactions, especially about the benefits, might have been reinforced by media attention or optimistic marketing of medical cannabis (Sexton 2021). A media content analysis by Abraham et al. (2018) demonstrated an increase in media articles with favorable references to cannabis, including information on therapeutic benefits that lack scientific evidence. This trend is reinforced by NGOs and lobbying parties in favor of legislation of cannabis (Bramness et al. 2018). Medical cannabis products are sometimes incorrectly viewed and marketed as a “miracle cure” (for an illustration applied to Parkinson’s disease, see Robledo and Jankovic (2017)), but it is important to consider the context. While cannabis and pharmaceutical industries are investing to bring a growing number of products with optimistic claims about a market that is not thoroughly regulated, research on cannabis in academia is often hampered, by which robust evidence on

the potential benefits of cannabis is still limited (Sexton 2021). As research from Australia illustrates, positive media coverage can not only counter dominating negative cannabis narratives (Chiu et al. 2022), but can also improve attitudes and behavioral intentions among users and non-users (D'Amico et al. 2018).

Aside from the positive perceptions, it is important to examine what drives these perceptions and behavioral intentions. Subjective/objective knowledge and social trust, which do not appear to be associated with each other, have a negative and positive influence on the perceptions of, respectively, the risks and benefits of medical cannabis. Both types of knowledge are moderately correlated, which is more likely to be the case for credence goods (Park, Mothersbaugh & Feick 1994). However, subjective knowledge is a stronger determinant than objective knowledge, which corresponds with consumer studies on, for instance, green purchase behavior (Park & Sohn 2018). As the opposite has been reported as well (De Steur et al. 2014), it remains important to compare the role of both knowledge measures in future consumer research (Park, Mothersbaugh & Feick 1994). Our model also showed that both benefit and risk perceptions affect behavioral intention, but in the opposite direction. The pathway "subjective knowledge - benefits perceptions - behavioral intention" is considered the strongest. This is an important finding, as current knowledge levels are rather low despite the widespread public use of cannabis products (Borille et al. 2017; Gonçalves et al. 2019). The lack of knowledge about medical cannabis and the need for public education have been raised before (Felnhofer et al. 2021). Similar education and knowledge challenges occur in expert populations, such as physicians (Bonnici & Clark 2021; Ng et al. 2021; Szaflarski et al. 2020; Takakuwa et al. 2021), pharmacists (Reece, Holle & Mukherjee 2021; Szaflarski et al. 2020), social workers (Findley et al. 2021), or students in expert domains (Caligiuri, Ulrich & Welter 2018; Felnhofer et al. 2021; Moeller, McGuire & Melton 2020; Pierre, Matthews & Walsh 2020; Sokratous et al. 2021), and are not expected to change over time (Weisman & Rodríguez 2021). As is the case for other novel products (Kamrath et al. 2019; Onwezen et al. 2020;

Vermeir et al. 2020), enhancing knowledge as well as investing in benefits communication could further improve public perceptions and ensure informed choices.

Cluster analysis identified three public segments, with half of the sample being part of the positive cluster and the other half distributed over the cautious and enthusiastic clusters. Age of respondents is significantly higher in the positive and enthusiastic clusters. Their positive perceptions correspond with recent evidence on regular cannabis use in older populations (Han et al. 2021) and are likely linked to the relevancy of medical cannabis for treating joint inflammation, pain, and muscle spasms in elderly (Gonçalves et al. 2019). Also, highly educated people are more likely to belong to the positive and enthusiastic clusters, which might be linked to the role of knowledge as a determinant of medical cannabis perceptions. Finally, while some student-oriented studies point to more positively oriented males (Felnhofer et al. 2021; Sobczynski et al. 2013), our study did not reveal any gender effect, in line with Konstantinov et al. (2021).

Our study has several limitations. Study limitations include use of a convenience sample which is not representative of the population (see the footnote of Supplementary Table 1). The fact that the average respondent in our sample is (very) positive toward medical cannabis might be due to the relatively higher proportion of highly educated respondents. Nevertheless, our large sample size did allow for advanced analysis of a study population that has been rarely targeted. Secondly, our survey was administered in a specific study location. More research is needed in different settings and policy contexts. Whether or not the public perceptions would be different when targeting cannabis for recreational use, also remains to be examined. Previous research showed a discrepancy in public/expert perceptions between medical and recreational cannabis regarding its legalization (Arora et al. 2020) or use (Gates, Todd & Copeland 2017; Gazibara et al. 2017; Szaflarski et al. 2020). Thirdly, regarding the determinants of behavioral intention, this study mainly looked at cognitive and attitudinal factors. There may be limitations of our objective knowledge measurement and its inclusion

as a single-item measure in our SEM analysis (Hayduk & Littvay 2012). More research is needed to validate or improve this measure.

As the need for research and development of medical cannabis (National Academies of Sciences & Medicine 2017) goes hand in hand with the need for more evidence on public perceptions, our study helped to fill this gap, and provides strong evidence on the associations between knowledge and perceptions on the one hand, and behavioral intentions on the other. Cannabis has medical properties to help alleviate certain diseases with an appropriate dosage, but it can be harmful and should not be considered a miracle cure (Pratt et al. 2019). While this study points to positive public perceptions of cannabis for medical purposes, scientific research on its efficacy is still highly needed. This is particularly important because changes in legislation can improve perceptions (Gali et al. 2021) and increase the use of cannabis and illicit drugs (Treister-Goltzman et al. 2019).

## Declarations


### Funding information

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### Competing interests

The authors have no competing interests.

### Authorship confirmation

**MP:** Conceptualization (lead); Methodology (lead); Investigation (lead); formal analysis (supporting); writing – original draft (equal); review and editing (equal). **GH:** Conceptualization (supporting); writing – review and editing (equal). **HDS:** Conceptualization (supporting); Methodology (supporting); investigation (supporting); formal analysis (lead); writing – original draft (equal); writing – review and editing (lead).

### Data availability

The dataset is available from the corresponding author on reasonable request.

**References**


Abraham, A.; Zhang, A.J.; Ahn, R.; Woodbridge, A.; Korenstein, D. & Keyhani, S. 2018. Media content analysis of marijuana's health effects in news coverage. *Journal of general internal medicine* 33(9):1438-1440.

Arnfinsen, J.L. & Kisa, A. 2021. Assessment of Norwegian physicians' knowledge, experience and attitudes towards medical cannabis. *Drugs: Education, Prevention and Policy* 28(2):165-171.

Arora, K.; Qualls, S.H.; Bobitt, J.; Lum, H.D.; Milavetz, G.; Croker, J. & Kaskie, B. 2020. Measuring attitudes toward medical and recreational cannabis among older adults in Colorado. *The Gerontologist* 60(4):e232-e241.

Banwell, E.; Pavisian, B.; Lee, L. & Feinstein, A. 2016. Attitudes to cannabis and patterns of use among Canadians with multiple sclerosis. *Multiple sclerosis and related disorders* 10:123-126.

Bawin, F. 2020. Self-reported medicinal cannabis use in Flanders: a study of user profiles and patterns of use. PhD dissertation: Ghent University.

Bonn-Miller, M.O.; Loflin, M.J.; Thomas, B.F.; Marcu, J.P.; Hyke, T. & Vandrey, R. 2017. Labeling accuracy of cannabidiol extracts sold online. *Jama* 318(17):1708-1709.

Bonnici, J. & Clark, M. 2021. Maltese Health and Social Wellbeing Student Knowledge, Attitudes and Beliefs about Medical Cannabis. *Complementary Therapies in Medicine*:102753.

Borille, B.T.; González, M.; Steffens, L.; Ortiz, R.S. & Limberger, R.P. 2017. Cannabis sativa: a systematic review of plant analysis. *Drug Analytical Research* 1(1):1-23.

Bramness, J.G.; Dom, G.; Gual, A.; Mann, K. & Wurst, F.M. 2018. A survey on the medical use of cannabis in Europe: A position paper. *European Addiction Research* 24(4):201-205.

Caligiuri, F.J.; Ulrich, E.E. & Welter, K.J. 2018. Pharmacy student knowledge, confidence and attitudes toward medical cannabis and curricular coverage. *American journal of pharmaceutical education* 82(5).

Carlson, J.P.; Vincent, L.H.; Hardesty, D.M. & Bearden, W.O. 2009. Objective and subjective knowledge relationships: A quantitative analysis of consumer research findings. *Journal of Consumer Research* 35(5):864-876.

Cerino, P.; Buonerba, C.; Cannazza, G.; D'Auria, J.; Ottoni, E.; Fulgione, A.; Di Stasio, A.; Pierri, B. & Gallo, A. 2021. A review of hemp as food and nutritional supplement. *Cannabis and Cannabinoid Research* 6(1):19-27.

Chiu, V.; Chan, G.; Hall, W.; Hides, L. & Leung, J. 2022. Trends in cannabis use intention around the period of cannabis legalisation in Australia: An age-period-cohort model. *Drug and alcohol review*.

Clarke, R.C. & Merlin, M.D. 2016. Cannabis domestication, breeding history, present-day genetic diversity, and future prospects. *Critical reviews in plant sciences* 35(5-6):293-327.

Connor, M. & Siegrist, M. 2010. Factors influencing people's acceptance of gene technology: The role of knowledge, health expectations, naturalness, and social trust. *Science communication* 32(4):514-538.

D'Amico, E.J.; Rodriguez, A.; Tucker, J.S.; Pedersen, E.R. & Shih, R.A. 2018. Planting the seed for marijuana use: Changes in exposure to medical marijuana advertising and subsequent adolescent marijuana use, cognitions, and consequences over seven years. *Drug and alcohol dependence* 188:385-391.

De Steur, H.; Blancquaert, D.; Lambert, W.; Van Der Straeten, D. & Gellynck, X. 2014. Conceptual framework for ex-ante evaluation at the micro/macro level of GM crops with health benefits. *Trends in food science & technology* 39(2):116-134.

Faber, I.; Castellanos-Feijoó, N.A.; Van de Sompel, L.; Davydova, A. & Perez-Cueto, F.J. 2020. Attitudes and knowledge towards plant-based diets of young adults across four European countries. Exploratory survey. *Appetite* 145:104498.

FAMPH 2021. Frequently asked questions about medicines and other products based on cannabis or cannabidiol, available at https://www.famhp.be/en/human_use/particular_products/specially_reglemented_substances/narcotics_psychotropics/frequently.

Felnhofer, A.; Kothgassner, O.D.; Stoll, A. & Klier, C. 2021. Knowledge about and attitudes towards medical cannabis among Austrian university students. *Complementary Therapies in Medicine* 58:102700.

Findley, P.A.; Edelstein, O.E.; Pruginin, I.; Reznik, A.; Milano, N. & Isralowitz, R. 2021. Attitudes and beliefs about medical cannabis among social work students: Cross-national comparison. *Complementary Therapies in Medicine* 58:102716.
FPS Health Food Chain Safety and Environment 2022. Questions & answers on the use of hemp (cannabis sativa L.) and cannabinoids (such as cannabidiol) as or within foodstuffs, available at https://www.health.belgium.be/en/faq-cannabis. Brussels, Belgium: FPS Health, Food Chain Safety and Environment.
Gali, K.; Winter, S.J.; Ahuja, N.J.; Frank, E. & Prochaska, J.J. 2021. Changes in cannabis use, exposure, and health perceptions following legalization of adult recreational cannabis use in California: a prospective observational study. *Substance abuse treatment, prevention, and policy* 16(1):1-10.
Gates, P.; Todd, S. & Copeland, J. 2017. Survey of Australian's knowledge, perception and use of cannabis for medicinal purposes. *J Addict Prev* 5(1):10.
Gazibara, T.; Prpic, M.; Maric, G.; Pekmezovic, T. & Kisic-Tepavcevic, D. 2017. Medical cannabis in Serbia: The survey of knowledge and attitudes in an urban adult population. *Journal of psychoactive drugs* 49(3):217-224.
Gonçalves, J.; Rosado, T.; Soares, S.; Simão, A.Y.; Caramelo, D.; Luís, Â.; Fernández, N.; Barroso, M.; Gallardo, E. & Duarte, A.P. 2019. Cannabis and its secondary metabolites: their use as therapeutic drugs, toxicological aspects, and analytical determination. *Medicines* 6(1):31.
Hair, J.F. 2009. Multivariate data analysis.
Hall, W. 2022. The costs and benefits of cannabis control policies. *Dialogues in clinical neuroscience*.
Han, B.H.; Funk-White, M.; Ko, R.; Al-Rousan, T. & Palamar, J.J. 2021. Decreasing perceived risk associated with regular cannabis use among older adults in the United States from 2015 to 2019. *Journal of the American Geriatrics Society*.
Hayduk, L.A. & Littvay, L. 2012. Should researchers use single indicators, best indicators, or multiple indicators in structural equation models? *BMC medical research methodology* 12(1):1-17.
Henriquez, P.C. & Hamilton, H. 2019. Perception of harm and benefits of adolescents about the use of marijuana, Province of Conception, Chile. *Texto & Contexto-Enfermagem* 28.
Jacobs, R.J.; Kane, M.N. & Caballero, J. 2022. Predictors of Medical Students' Perceptions About Medical Cannabis. *Cureus* 14(4).
Kamrath, C.; Wesana, J.; Bröring, S. & De Steur, H. 2019. What do we know about chain actors' evaluation of new food technologies? A systematic review of consumer and farmer studies. *Comprehensive reviews in food science and food safety* 18(3):798-816.
Kaplan, L.; Klein, T.; Wilson, M. & Graves, J. 2020. Knowledge, practices, and attitudes of Washington state health care professionals regarding medical cannabis. *Cannabis and Cannabinoid Research* 5(2):172-182.
Khamenka, N. & Pikirenia, U. 2021. Knowledge, attitudes and beliefs about medical cannabis among the medical students of the Belarus State Medical University. *Complementary Therapies in Medicine* 57:102670.
Konstantinov, V.; Reznik, A.; Zangeneh, M.; Gritsenko, V.; Khamenka, N.; Kalita, V. & Isralowitz, R. 2021. Foreign Medical Students in Eastern Europe: Knowledge, Attitudes and Beliefs about Medical Cannabis for Pain Management. *International Journal of Environmental Research and Public Health* 18(4):2137.
Kruse, D. 2016. *THC regulations regarding industrial hemp in the EU*: HempConsult GmbH. http://iiha.ie/wp-content/uploads/2018/03/THC-Regulations-regarding-industrial-hemp-in-the-EU-20160901.pdf
Luque, J.S.; Okere, A.N.; Reyes-Ortiz, C.A. & Williams, P.M. 2021. Mixed methods study of the potential therapeutic benefits from medical cannabis for patients in Florida. *Complementary Therapies in Medicine* 57:102669.
Magnan, R.E. & Ladd, B.O. 2019. "It's all good": Perceived benefits but not perceived risks or worries among adult marijuana users. *Cannabis* 2(2):112-119.
Manning, L. & Bouchard, L. 2021. Medical cannabis use: exploring the perceptions and experiences of older adults with chronic conditions. *Clinical Gerontologist* 44(1):32-41.
Manthey, J. 2019. Cannabis use in Europe: Current trends and public health concerns. *International Journal of Drug Policy* 68:93-96.
McKelvey, K.; Gaiha, S.M.; Delucchi, K.L. & Halpern-Felsher, B. 2021. Measures of both perceived general and specific risks and benefits differentially predict adolescent and young adult tobacco

and marijuana use: findings from a Prospective Cohort Study. *Humanities and Social Sciences Communications* 8(1):1-9.
Moeller, K.E.; McGuire, J.M. & Melton, B.L. 2020. A nationwide survey of pharmacy students' knowledge and perceptions regarding medical cannabis. *Journal of the American Pharmacists Association* 60(1):218-224. e3.
Moeller, K.E. & Woods, B. 2015. Pharmacy students' knowledge and attitudes regarding medical marijuana. *American Journal of Pharmaceutical Education* 79(6).
Mogendi, J.B.; De Steur, H.; Gellynck, X. & Makokha, A. 2016. Consumer evaluation of food with nutritional benefits: a systematic review and narrative synthesis. *International journal of food sciences and nutrition* 67(4):355-371.
National Academies of Sciences, E. & Medicine 2017. The health effects of cannabis and cannabinoids: the current state of evidence and recommendations for research. Washington DC: The National Academies Press.
Ng, J.Y.; Gilotra, K.; Usman, S.; Chang, Y. & Busse, J.W. 2021. Attitudes toward medical cannabis among family physicians practising in Ontario, Canada: a qualitative research study. *CMAJ open* 9(2):E342.
Onwezen, M.; Bouwman, E.; Reinders, M. & Dagevos, H. 2020. A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*:105058.
Park, C.W.; Mothersbaugh, D.L. & Feick, L. 1994. Consumer knowledge assessment. *Journal of consumer research* 21(1):71-82.
Park, J.O. & Sohn, S.-H. 2018. The role of knowledge in forming attitudes and behavior toward green purchase. *Social Behavior and Personality: an international journal* 46(12):1937-1953.
Park, S.-Y.; Constantino, N.; Yun, G.W.; Moser, L. & Cortes-Arriola, D. 2020. US college students' marijuana information sources, confidence in knowledge, and objective Knowledge. *Journal of Health Communication* 25(11):859-869.
Philpot, L.M.; Ebbert, J.O. & Hurt, R.T. 2019. A survey of the attitudes, beliefs and knowledge about medical cannabis among primary care providers. *BMC Family practice* 20(1):1-7.
Pierre, M.S.; Matthews, L. & Walsh, Z. 2020. Cannabis education needs assessment among Canadian physicians-in-training. *Complementary therapies in medicine* 49:102328.
Pratt, M.; Stevens, A.; Thuku, M.; Butler, C.; Skidmore, B.; Wieland, L.S.; Clemons, M.; Kanji, S. & Hutton, B. 2019. Benefits and harms of medical cannabis: a scoping review of systematic reviews. *Systematic reviews* 8(1):1-35.
Prohibition partners 2022. The European Cannabis Report. 7th edition. London, UK: Prohibition partners.
Reece, S.; Holle, L. & Mukherjee, K. 2021. Survey of Pharmacists' Knowledge of Connecticut's Medical Cannabis Program. *Cannabis and Cannabinoid Research* 6(1):66-73.
Robledo, I. & Jankovic, J. 2017. Media hype: patient and scientific perspectives on misleading medical news. *Movement Disorders* 32(9):1319-1323.
Salloum, N.C.; Krauss, M.J.; Agrawal, A.; Bierut, L.J. & Grucza, R.A. 2018. A reciprocal effects analysis of cannabis use and perceptions of risk. *Addiction* 113(6):1077-1085.
Sexton, M. 2021. Conflict and Consensus When Worlds Collide: The Intersection of Cannabis Citizen Science and Academia *The Routledge Handbook of Post-Prohibition Cannabis Research*: Routledge.
Shorey Fennell, B.; Magnan, R.E.; Ladd, B.O. & Fales, J.L. 2022. Young Adult Cannabis Users' Perceptions of Cannabis Risks and Benefits by Chronic Pain Status. *Substance Use & Misuse* 57(11):1647-1652.
Siegrist, M. 2000. The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk analysis* 20(2):195-204.
Sobczynski, J.; Drozd, M.; Wosko, S.; Wielgus, S.; Ostapkiewicz, A.; Kochaniec, M. & Szymanska, J. 2013. Evaluation of students' knowledge of cannabis influence on human health. *Current Issues in Pharmacy and Medical Sciences* 26(2):235-239.
Sokratous, S.; Mpouzika, M.D.; Kaikoushi, K.; Hatzimilidonis, L.; Koutroubas, V.S. & Karanikola, M.N. 2021. Medical cannabis attitudes, beliefs and knowledge among Greek-Cypriot University nursing students. *Complementary therapies in medicine* 58:102707.

Szaflarski, M.; McGoldrick, P.; Currens, L.; Blodgett, D.; Land, H.; Szaflarski, J.P. & Segal, E. 2020. Attitudes and knowledge about cannabis and cannabis-based therapies among US neurologists, nurses, and pharmacists. *Epilepsy & Behavior* 109:107102.

Szyliowicz, D. & Hilsenrath, P. 2019. Medical marijuana knowledge and attitudes: a survey of the California Pharmacists Association. *Journal of primary care & community health* 10:2150132719831871.

Takakuwa, K.M.; Mistretta, A.; Pazdernik, V.K. & Sulak, D. 2021. Education, knowledge, and practice characteristics of cannabis physicians: a survey of the Society of Cannabis Clinicians. *Cannabis and Cannabinoid Research* 6(1):58-65.

Treister-Goltzman, Y.; Freud, T.; Press, Y. & Peleg, R. 2019. Trends in publications on medical cannabis from the year 2000. *Population health management* 22(4):362-368.

Vanhonacker, F.; Van Loo, E.J.; Gellynck, X. & Verbeke, W. 2013. Flemish consumer attitudes towards more sustainable food choices. *Appetite* 62:7-16.

Vermeir, I.; Weijters, B.; De Houwer, J.; Geuens, M.; Slabbinck, H.; Spruyt, A.; Van Kerckhove, A.; Van Lippevelde, W.; De Steur, H. & Verbeke, W. 2020. Environmentally sustainable food consumption: A review and research agenda from a goal-directed perspective. *Frontiers in Psychology* 11:1603.

Weisman, J.M. & Rodríguez, M. 2021. A systematic review of medical students' and professionals' attitudes and knowledge regarding medical cannabis. *Journal of Cannabis Research* 3(1):1-20.

**Supplementary Table 1.** Socio-demographic profile of the sample (n=656)

| | N | % |
|---|---|---|
| Gender | | |
| Male | 393 | 59.9 |
| Female | 263 | 40.1 |
| Education | | |
| Low | 260 | 39.6 |
| *No diploma* | *6* | *0.9* |
| *Primary education* | *12* | *1.8* |
| *Secondary education* | *242* | *36.9* |
| High | 396 | 60.4 |
| *University of applied sciences* | *201* | *30.6* |
| *University* | *195* | *29.7* |
| Having children | | |
| Yes | 368 | 56.1 |
| No | 288 | 43.9 |
| Region | | |
| Walloons (French-speaking) | 132 | 20.1 |
| Flanders (Dutch-speaking) | 524 | 79.9 |
| | **Mean** | **SD** |
| Age | 38.0 | 14.7 |

SD, Standard deviation

Note: When compared with 2020/2021 national numbers (https://statbel.fgov.be/en/themes/population/structure-population), our sample has a higher share of males (59.9% vs 49.3%), Flemish (79.9% vs 57.0%), and higher educated people 60.4% vs 49.9%), while the mean age was lower (38.0 vs 41.9 years).

**Supplementary Table 2.** Validity, reliability and goodness of fit of the measurement model (confirmatory factor analysis)

| | **Stand. FL** | **Cronbach alpha** | **1** | **2** | **3** | **4** | **CR** | **AVE** | **Goodness-of-fit** |
|---|---|---|---|---|---|---|---|---|---|
| SubjKnow1 | 0.938 | 0.751 | 1 | | | | 0.941 | 0.799 | chi²(94)= 256,297, p < 0.001; chi²/df.=2.72; RMSEA=0.051; SRMR=0.036; CFI=0.973; TLI=0.966 |
| SubjKnow2 | 0.949 | | | | | | | | |
| SubjKnow3 | 0.894 | | | | | | | | |
| SubjKnow4 | 0.787 | | | | | | | | |
| SocTrust1 | 0.762 | 0.939 | 0.000 | 1 | | | 0.754 | 0.507 | |
| SocTrust2 | 0.736 | | | | | | | | |
| SocTrust3 | 0.632 | | | | | | | | |
| PercBenef1 | 0.722 | 0.783 | 0.175 | 0.066 | 1 | | 0.796 | 0.566 | |
| PercBenef3 | 0.783 | | | | | | | | |
| PercBenef4 | 0.750 | | | | | | | | |
| PercRisk1 | 0.640 | 0.762 | 0.199 | 0.020 | 0.274 | 1 | 0.768 | 0.530 | |
| PercRisk2 | 0.856 | | | | | | | | |
| PercRisk3 | 0.668 | | | | | | | | |
| BehavIntent1 | 0.581 | 0.702 | 0.130 | 0.056 | 0.417 | 0.304 | 0.847 | 0.656 | |
| BehavIntent2 | 0.917 | | | | | | | | |
| BehavIntent3 | 0.889 | | | | | | | | |

AVE: Average Variance Extracted; CR: Composite reliability, FL, factor loadings

Note: Numbers below the diagonals illustrate squared correlation coefficients. All factor loadings are significant at p<0,001. Because objective knowledge is a single-item variable based on the % of correct responses on true/false questions, it is excluded here from the confirmatory factor analysis.