

Prevention needs and target behavior preferences in an app-based addiction prevention program for German vocational students: A cluster-randomized controlled trial

Diana Guertler, Elaine Kraft, Dominic Bläsing, Anne Möhring, Christian Meyer, Hannah Schmidt, Florian Rehbein, Merten Neumann, Arne Dreißigacker, Anja Bischof, Gallus Bischof, Svenja Sürig, Lisa Hohls, Susanne Wurm, Stefan Borgwardt, Severin Haug, Hans-Jürgen Rumpf

Submitted to: JMIR mHealth and uHealth
on: April 16, 2024

Disclaimer: © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on its website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressly prohibit redistribution of this draft paper other than for review purposes.

Table of Contents

Original Manuscript.....	5
Supplementary Files.....	38
Figures	39
Figure 1.....	41
Figure 2.....	42
Figure 3.....	43
Figure 4.....	44
Multimedia Appendixes	45
Multimedia Appendix 1.....	46
Multimedia Appendix 2.....	46
Multimedia Appendix 3.....	46
Multimedia Appendix 4.....	46

Prevention needs and target behavior preferences in an app-based addiction prevention program for German vocational students: A cluster-randomized controlled trial

Diana Guertler^{1, 2, 3}; Elaine Kraft¹; Dominic Bläsing⁴; Anne Möhring^{2, 3}; Christian Meyer^{1, 2}; Hannah Schmidt^{5, 6}; Florian Rehbein⁷; Merten Neumann⁸; Arne Dreißigacker⁸; Anja Bischof⁵; Gallus Bischof⁵; Svenja Sürig⁵; Lisa Hohls⁵; Susanne Wurm¹; Stefan Borgwardt⁵; Severin Haug⁹; Hans-Jürgen Rumpf⁵

¹Department of Prevention Research and Social Medicine Institute for Community Medicine University Medicine Greifswald Greifswald DE

²DZHK (German Centre for Cardiovascular Research), partner site Greifswald Greifswald DE

³Department of Methods of Community Medicine Institute for Community Medicine University Medicine Greifswald Greifswald DE

⁴Helmholtz Institute for One Health Greifswald DE

⁵Department of Psychiatry and Psychotherapy University of Lübeck Lübeck DE

⁶Department of Pediatrics University of Lübeck Lübeck DE

⁷Department of Social Work FH Münster University of Applied Sciences Münster DE

⁸Criminological Research Institute of Lower Saxony (KFN) Hannover DE

⁹Swiss Research Institute for Public Health and Addiction University of Zürich Zürich CH

Corresponding Author:

Diana Guertler

Department of Methods of Community Medicine

Institute for Community Medicine

University Medicine Greifswald

Walther-Rathenau-Str. 48

Greifswald

DE

Abstract

Background: Vocational school students exhibit a high prevalence of addictive behaviors. Digital prevention programs targeting multiple addictive behaviors and promoting life skills are promising. Tailoring intervention content to participants' preferences, such as allowing them to choose behavior modules, may increase engagement and efficacy. However, there is limited understanding of how personal characteristics relate to module choices.

Objective: This paper examines the prevention needs of German vocational school students as well as their prevention preferences through self-determined module choice in the multi-behavior app-based addiction prevention program "ready4life".

Methods: A two-arm cluster-randomized controlled trial recruited German vocational students aged 16+ years. Among 376 classes from 35 schools, "ready4life" was introduced during a school lesson. Students were invited to download the "ready4life" app, and completed an anonymous screening with individualized risk and competence feedback in form of a traffic light system. Informed consent was given by 2568 students. Intervention classes received individual app-based coaching, with weekly chat contacts with a virtual coach over four months. They could choose two out of six modules: alcohol, tobacco, cannabis, social media/gaming, stress and social competencies. Module choice was self-determined. Control group classes received a link to health behavior information and could access coaching after 12 months.

Results: Prevention need was high. For 86% two or more risks were reported according to a yellow or red traffic light feedback. Within the intervention group, stress (818/1236, 66.2%) and social media/gaming (625/1236, 50.6%) were the most chosen topics, followed by alcohol (360/1236, 29.1%), social competencies (306/1236, 24.8%), tobacco (232/1236, 18.8%), and cannabis (131/1236, 10.6%). Module choices closely aligned with received traffic light feedback, particularly among those with one or two risks. Multilevel regression models showed females were significantly more likely to choose the stress module ($P<.001$; OR 2.38, 95% CI 1.69-3.33), while males preferred social media/gaming ($P<.001$; OR 0.52, 95% CI 0.40-0.69), alcohol ($P<.001$; OR 0.50, 95% CI 0.37-0.67) and cannabis ($P<.001$; OR 0.37, 95% CI 0.21-0.63), when holding age, education track and prevention need for the respective behavior constant. Younger students were significantly more likely to choose the cannabis

module ($P < .001$; OR 0.81, 95% CI 0.74-0.90). Educational track also influenced module choice, e.g., those with lower education were more likely to choose alcohol and cannabis, suggesting a positive equity impact. Students' prevention needs significantly influenced choice of the corresponding module, e.g., higher alcohol consumption increased the likelihood of choosing the alcohol module ($P < .001$; OR 1.31, 95% CI 1.20-1.43).

Conclusions: Our study confirms vocational students' high prevention needs regarding addictive behaviors. A key finding was the high congruence between students' module choices and their demonstrated needs, with most students being interested in the stress module. Module choice also differed by age, gender, and educational track. Clinical Trial: German Clinical Trials Register (DRKS): DRKS00022328

(JMIR Preprints 16/04/2024:59573)

DOI: <https://doi.org/10.2196/preprints.59573>

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**

Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.

No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain visible to all users.

Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in a JMIR journal, my full manuscript will be made available to all users.

No. Please do not make my accepted manuscript PDF available to anyone. I understand that if I later pay to participate in a JMIR journal, my full manuscript will be made available to all users.

Original Manuscript

Original Paper

Authors

Guertler D¹²³, Kraft E¹, Bläsing D⁴, Möhring A²³, Meyer C¹², Schmidt H⁵⁶, Rehbein F⁷, Neumann M⁸, Dreißigacker A⁸, Anja Bischof⁵, Gallus Bischof⁵, Svenja Sürig⁵, Hohls L⁵, Wurm S¹, Borgwardt S⁵, Haug S⁹, Rumpf H-J⁵

¹ Department of Prevention Research and Social Medicine, Institute for Community Medicine, University Medicine Greifswald, Greifswald, Germany

² DZHK (German Centre for Cardiovascular Research), partner site Greifswald, Germany

³ Department of Methods of Community Medicine, Institute for Community Medicine, University Medicine Greifswald, Greifswald, Germany

⁴ Helmholtz Institute for One Health, Greifswald

⁵ Department of Psychiatry and Psychotherapy, University of Lübeck, Lübeck, Germany

⁶ Department of Pediatrics, University of Lübeck, Lübeck, Germany

⁷ Department of Social Work, FH Münster University of Applied Sciences, Muenster, Germany

⁸ Criminological Research Institute of Lower Saxony (KFN), Hannover, Germany

⁹ Swiss Research Institute for Public Health and Addiction, University of Zurich, Zurich, Switzerland

Corresponding Author:

Diana Guertler, Institute for Community Medicine, University Medicine Greifswald, Walther-Rathenau-Str. 48, 17475 Greifswald, Germany, Phone: +493834-867765, Fax: +4903834-867766, Email: diana.guertler@med.uni-greifswald.de

Title: Prevention needs and target behavior preferences in an app-based addiction prevention program for German vocational students: A cluster-randomized controlled trial

Abstract (max. 450 words)

Background: Vocational school students exhibit a high prevalence of addictive behaviors.

Mobile prevention programs targeting multiple addictive behaviors and promoting life skills are promising. Tailoring intervention content to participants' preferences, such as allowing them to choose behavior modules, may increase engagement and efficacy. However, there is limited understanding of how personal characteristics relate to module choices.

Objective: This paper examines the prevention needs of German vocational school students as well as their prevention preferences through self-determined module choice in the multi-behavior app-based addiction prevention program "ready4life".

Methods: A two-arm cluster-randomized controlled trial recruited German vocational students aged 16+ years. Among 376 classes from 35 schools, "ready4life" was introduced during a school lesson. Students were invited to download the "ready4life" app, and completed an anonymous screening with individualized risk and competence feedback in form of a traffic light system. Informed consent was given by 2568 students. Intervention classes received individual app-based coaching, with weekly chat contacts with a virtual coach over four months. They could choose two out of six modules: alcohol, tobacco, cannabis, social media/gaming, stress and social competencies. Module choice was self-determined. Control group classes received a link to health behavior information and could access coaching after 12 months.

Results: Prevention need was high. For 86% two or more risks were reported according to a yellow or red traffic light feedback. Within the intervention group, stress (818/1236, 66.2%) and social media/gaming (625/1236, 50.6%) were the most chosen topics, followed by alcohol (360/1236, 29.1%), social competencies (306/1236, 24.8%), tobacco (232/1236, 18.8%), and cannabis (131/1236, 10.6%). Module choices closely aligned with received traffic light feedback, particularly among those with one or two risks. Multilevel regression models showed females were significantly more likely to choose the stress module ($P<.001$; OR 2.38, 95% CI 1.69-3.33), while males preferred social media/gaming ($P<.001$; OR 0.52, 95% CI 0.40-0.69), alcohol ($P<.001$; OR 0.50, 95% CI 0.37-0.67) and cannabis ($P<.001$; OR 0.37, 95% CI 0.21-0.63), when holding age, education track and prevention need for the respective behavior constant. Younger students were significantly more likely to choose the cannabis module ($P<.001$; OR 0.81, 95% CI 0.74-0.90). Educational track also influenced module choice, e.g., those with lower education were more likely to choose alcohol and cannabis, suggesting a positive equity impact. Students' prevention needs significantly influenced choice of the corresponding module, e.g., higher alcohol consumption increased the likelihood of choosing the alcohol module ($P<.001$; OR 1.31, 95% CI 1.20-1.43).

Conclusions: Our study confirms vocational students' high prevention needs regarding addictive behaviors. A key finding was the high congruence between students' module choices and their demonstrated needs, with most students being interested in the stress module. Module choice also differed by age, gender, and educational track.

Trial Registration: German Clinical Trials Register (DRKS): DRKS00022328

Keywords (3 to 10): eHealth; computer-tailoring; multiple addictive behaviors; vocational students; module choice

Introduction

Addictive behaviors in vocational school students

Adolescence and young adulthood are periods of life associated with a number of challenges, including entering the world of work and increasing independence from parents. Addictive behaviors such as consumption of alcohol, tobacco and cannabis [1], but also problematic internet use [2] are particularly widespread in this phase of life.

Many adolescents and young adults in Germany attend vocational schools to start an apprenticeship, to attend vocational grammar school or vocational preparation courses. Vocational schools are promising settings for prevention efforts [3], especially as there is evidence that students in vocational schools report even higher rates of substance use than other adolescents and young adults. For example, in a survey of 5688 German vocational school students, the reported smoking rate was more than twice as high than that of their peers in the general population [4]. Representative data from German vocational students in Mecklenburg-Western Pomerania also show particularly high rates of problematic alcohol consumption (62%), smoking (62%) and cannabis use (26%). The study also provided a first insight into the prevalence of media-related problems among German vocational school students: Problematic internet use was reported by 17% of vocational school students, problematic gaming by 10% and potential smartphone addiction by 17% [5]. This is supported by findings from an intervention trial to reduce problematic use of the Internet in vocational school students [6].

In vocational school settings, achieving prevention goals typically requires a shift away from primary prevention strategies. Instead, indicated prevention programs are considered more appropriate, as the large majority of vocational students already initiated addictive behavior. A high proportion of vocational students also engage in multiple health risk behaviors, especially multiple addictive behaviors [5, 7]. However, they differ widely in their risk profiles, i.e., in the combinations and number of addictive behaviors. Vocational students also differ in other factors that may contribute to addictive behaviors, such as low social competence or high work stress. This means that complex interventions are needed to address different risk profiles.

Tailored mobile interventions

Mobile interventions are best suited to address various risk profiles as they can be easily adapted to the needs of the users and allow timely and anonymous participation. Mobile interventions have been shown to be effective in changing multiple addictive behaviors in vocational students [8, 9].

Mobile interventions have the advantage of automated delivery of highly individualized content through computer-tailoring. Tailoring is a key component in ensuring the effectiveness of an intervention [10]. With tailoring, feedback that is relevant to the individual is derived from an individual assessment based on pre-specified rules. Examples include content or wording tailored to users' gender or motivation to change. It has been shown that tailored feedback compared to generic feedback is more likely to be processed and remembered [11]. In addition to automatic computer tailoring, some interventions included forms of self-tailoring, such as allowing participants to choose the medium [12], dose [13] or content of the interventions, e.g. specific behavioral targets or modules [14-17]. In line with theoretical frameworks such as self-determination theory, self-tailoring is assumed to increase autonomy [18].

Although effective, adherence is a major challenge for many mobile health interventions [19], including approaches among vocational students [20]. Low adherence may partly explain the lack of long-term effects and small effect sizes in mobile health interventions [21]. Allowing participants the autonomy to choose which behavioral module(s) to engage with could positively influence engagement and efficacy [22, 23]. Within the vocational context, offering a choice of intervention modules could be valuable, particularly as many vocational students exhibit multiple addictive behaviors [5, 7]. Attempting to address all these behaviors simultaneously might be overwhelming [24], especially considering the decreasing intention to change all behaviors as their number increases [25].

Mechanisms of module choice

While some research has explored participants' module choices in multi-behavior interventions [14, 15, 26-31], there is limited understanding of the underlying choice mechanisms, such as which personal characteristics are related to choice. Investigating this is crucial, as diverse subgroups may utilize interventions differently, and some may not use it as recommended, e.g., not choosing the recommended module(s). Such insights can inform tailored strategies to align interventions with participant needs, reducing non-adherence and enhancing intervention exposure and effectiveness.

Most of the evidence on module choice preferences comes from multiple behavior interventions in adults. These studies have shown that certain modules are preferred over others, for example, physical activity over diet [14, 15, 26]. There is also consistency that health promoting-behaviors such as physical activity and diet are preferred over substance-related modules [14, 15, 26-31]. Two studies among vocational students reported on choice preferences within multiple addictive behavior interventions. They showed that stress and non-substance-related behaviors such as social media use were chosen more often than substance-related behaviors such as smoking, alcohol or cannabis use [8, 17].

With regard to potential determinants of module choice, the results are less consistent [14-16, 27], and are likely to vary depending on the number and topics of available behavior modules to choose from, whether or not module recommendations were given, and whether any restrictions were placed on module choice (e.g., how many modules could be chosen, or whether modules could be chosen that were not recommended). Providing feedback or recommending modules may enhance the alignment between participants' module choice and their prevention needs [30]. Studies show that people are more inclined to choose modules that were recommended to them, based on their demonstrated risk profile [17, 29]. Consequently, most previous studies utilized feedback or recommendations to guide module choice [14-17, 26, 29, 32], with only a few exceptions [27, 28, 30, 33].

In web-based multiple behavior interventions for adults addressing a range of health promoting-behaviors and substance use, choice of the physical activity or diet related modules was associated with female gender [14] and healthier lifestyles [15]. In the study of Schulz et al. [15], choice of the alcohol module was linked with male gender, lower income and higher psychosocial distress, whereas medium (vs. high) education, lower quality of life and lower psychosocial distress were linked to choice of the smoking module. Reinwand et al. [34] showed that adherence to module recommendations in web-based multi-behavior interventions (i.e., starting all recommended modules vs. fewer) also depends on individual characteristics. Individuals were more likely to start all of the recommended modules if they

were older, female, unemployed, ill, and in a relationship.

The main gap in the existing research is that no study has reported on the determinants of module choice preferences among vocational school students, or statistically analyzed the alignment between prevention needs and module preferences in this group. This is particularly important given that a high proportion of vocational students engage in multiple addictive behaviors. Furthermore, although there have been previous studies on the prevalence of addictive behaviors among German vocational school students [5, 35], these studies did not analyze prevention needs in terms of life skills and their determinants. This has only been investigated in a Swiss sample [17].

Given the fact that lower educational attainment among vocational students is associated with higher prevalence [35] and clustering [5] of addictive behaviors, as well as lower engagement in mobile interventions [36], it is particularly important to analyze educational track as a potential determinant of module choice.

Aims

This study examines the prevention needs of German vocational school students as well as their module choices within the app-based addiction prevention intervention "ready4life". The "ready4life" intervention offers six behavior modules: alcohol, tobacco, cannabis, social media/gaming, stress and social competencies. After receiving feedback on their individual risks and competencies in the form of a traffic light system to guide choice, students could freely choose two out of the six modules to be coached in. In terms of module choice, we aim to examine (1) how often each intervention module was chosen, (2) how module choice aligned with the traffic light feedback received, and (3) whether individual characteristics (age, gender, educational track, and prevention needs) were associated with module choice. (4) The relationship between socio-demographic factors and module choice is likely to be influenced by the prevention needs of the students in this sample. Therefore, we are also analyzing how socio-demographics (age, gender, and educational track) are associated with prevention needs. This will provide a clearer understanding of how these factors may shape students' intervention preferences.

Prevention needs of vocational students in terms of addictive behaviors were expected to be high [5]. Based on the previous literature on module choice [8, 14, 15, 17, 26-31] and the generally low intentions to change addictive behaviors [5], it was expected that life skills modules (stress or social competencies) would be preferred over modules related to addictive behaviors. It was also expected that module choice showed a high alignment with the traffic light feedback received [8, 17, 29]. Given the differences in prevalence of substance use between the genders [37], it was expected that males would choose modules related to substance use more often than females.

Methods

Design

Data come from a cluster-randomized controlled trial among German vocational students testing the efficacy of the app-based addiction prevention program "ready4life" [38]. The trial was registered in the German Clinical Trials Register (DRKS): DRKS00022328.

Participants and procedures

Recruitment

Details on the recruitment can be found elsewhere [39]. Participants for this study were vocational students from five German federal states that were enrolled either in vocational training, vocational preparation or vocational grammar school. Randomization was performed on class level within computer-generated blocks of four and stratified by school (allocation ratio 1:1). Within the 35 participating schools, 376 classes were randomized to either intervention (n=186) or control condition (n=190), see Figure 1.

We used a facilitated access approach by proactively offering intervention participation during school hours. Combining mobile interventions with proactive contacting is crucial to maximize reach and representativeness of the sample [40], particularly for those not yet planning to change their behavior [41]. This is of high importance as the majority of vocational students do not intend yet to change their addictive behaviors [5].

Class introductions

During one to two school hours, students from both study groups were introduced to the study and were invited to download the “ready4life” app. During the introduction, students were given detailed information about the study, including its procedures, randomization process, data protection measures, and the content and features of the app. To minimize stigma associated with addiction, introductions largely focused on stress management. Class introductions were conducted between October 2020 and March 2022 by members of the project team (239/376, 63.6%), trained schoolteachers (56/376, 14.9%), addiction prevention experts (34/376, 9.0%), school social workers (22/376, 5.9%), or vocational students (25/376, 6.7%), either via face-to-face introductions (187/376, 49.7%), via online streaming (162/376, 43.1%) or an emailed YouTube video link (27/376, 7.2%).

Study participation

Vocational students, age 16+, with smartphones, that provided contact details (email/phone) for follow-up data collection were eligible for study participation. After downloading the app, all students participated in an anonymous in-app screening on their prevention needs regarding alcohol, tobacco, and cannabis consumption, internet use, social competencies, and stress. Students then provided digital informed consent. A total of 4225 app downloads were recorded and 2568 students provided informed consent (Figure 1). Participation rate was 46.7%.

All study participants received feedback on their individual risks and competencies in the form of a traffic light system, and were then informed of their group allocation. The intervention group then received app-based coaching for two self-selected behavior modules over 16 weeks (see Interventions section for details).

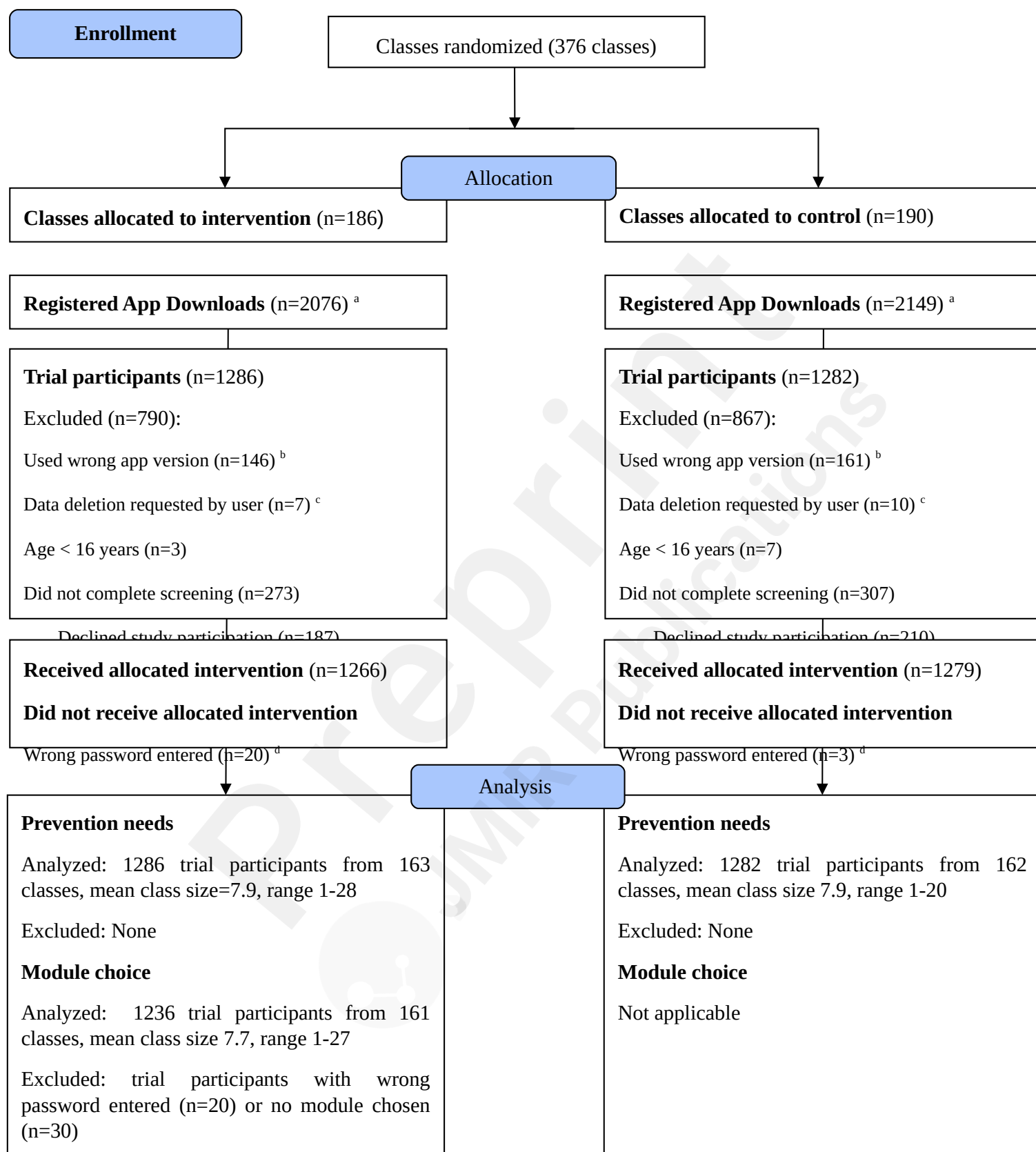


Figure 1. Flowchart of clusters and participants.

^a n=11 students were identified who had registered for the study twice; these have already been subtracted from the download count.

^b The app included multiple versions tailored to different countries or languages. Due to a technical issue between September 2, 2021, and December 10, 2021, 307 students were mistakenly directed to a different version of the app instead of the German version. As a result, these students used a version of the app that was not part of the current study, and informed consent could not be obtained from them.

^c App users were able to initiate the deletion of all data collected at any time-point regardless of whether they just started the screening or provided informed consent and were using the intervention already.

^d Group allocation was performed on class level based on class specific passwords; due to mistyping of passwords n=20 students from the intervention group did not receive access to the intervention and n=3 students of the control groups received access to the intervention.

Follow-up assessment

Students from both study groups were invited to two follow-up sessions at 6 and 12 months via SMS or email with a link to an online-based chat conversation with a virtual coach. If students did not respond after reminders they were contacted by the project team to provide the option to complete the follow-up during a telephone interview. Prizes were raffled after the 12-month follow-up to increase participant engagement. Prizes were drawn in cash instead of vouchers due to procurement constraints. Participants in both the intervention and control groups with available contact information were eligible. The raffle was based on credits earned in the app, with separate raffles for each group to avoid disadvantaging the control group. Participants were randomly selected for the prizes, which ranged from €10 to €500.

Instruments

Class registration data

Class level information was gathered during the registration process for classes, encompassing the federal state of the school, classes' educational track (vocational preparation, vocational training, and vocational grammar school), year of education, class size along with data concerning the introduction (e.g., number of students present, mode of introduction or introducing person). For students undergoing vocational training, the official label of their training was assessed, and occupations were classified using the German Classification of Occupations [42] (Table S1 in Multimedia Appendix 2). A recode table was used to convert these into the International Standard Classification of Occupations 2008 (ISCO-8) [43], which was used in the main analysis to ensure international compatibility (Table S2 in Multimedia Appendix 2).

Vocational preparation classes are designed for students with basic education to qualify for further vocational training. Vocational grammar schools, on the other hand, allow students to obtain a university entrance qualification. Vocational training typically combines part-time classroom study with on-the-job experience. Entry requirements vary, leading to differences in the socio-economic backgrounds of students on different tracks. Tracks leading to operational and support roles (i.e., clerical support workers, service and sales workers, craft-related trades workers, plant and machine operators and assemblers, elementary occupations) generally require lower academic qualifications and attract students from lower socio-economic backgrounds. For example, individuals from lower income backgrounds often choose these tracks because of financial constraints, limited access to higher education, or expectations of early entry into the labor market. Lower socio-economic status also results from the lower prestige and job security associated with these tracks compared to tracks leading to professional, technical and associate professional roles.

Individual screening data

Within the app-based screening, data at the individual level were collected including socio-demographics, addictive behaviors (alcohol, tobacco and cannabis consumption, problematic internet use), perceived stress and social competencies.

Socio-demographics. Age was calculated from the date of birth given by the students. Gender was assessed as male, female or other. When students selected “other”, we assessed their tendency to feel more masculine or feminine on a scale of 1 to 6. Due to limited numbers of students in the category of “other” (40/2568), those who tended to be more masculine (scores 1-3; 17/40) were categorized as masculine and those who tend to be more feminine (scores 4-6; 23/40) were categorized as feminine.

Alcohol consumption. Using questions from the Alcohol Use Disorders Identification Test - Consumption (AUDIT-C) [44], students reported their frequency of alcohol consumption in the past 30 days (0-30 days). For those who reported consumption, details of the type of drink and the number of drinks consumed on a typical day and the day with the most alcoholic drinks consumed in the last month were collected using a digital bar displaying common portion sizes (e.g. 0.5l beer, 2cl shot). Standard drinks were calculated from the selected drinks (1 standard drink = 12g alcohol). A quantity-frequency index was calculated by multiplying drinking days by typical standard drinks per day and dividing by 30.

Tobacco consumption. Frequency of smoking tobacco or using nicotine products in the past 30 days was assessed, with response options including (almost) daily, occasionally but not daily, or never. For those who reported smoking, the number of consumption days (0-30 days) and cigarettes smoked per day in the past month were assessed. A quantity-frequency index was calculated by multiplying days of use by cigarettes smoked per day and dividing by 30.

Cannabis consumption. Lifetime use of cannabis containing THC was assessed using the response options “no, never” and “yes”. For those who reported cannabis use, frequency in the last six months was assessed (not at all, once a month or less, 2-4 times a month, 2-3 times a week, 4 times a week or more), as well as the number of days of use in the last month (0-30 days).

Problematic internet use. The short version of the Compulsive Internet Use Scale (Short CIUS) [45] measured problematic internet use on a scale from 0 (“never”) to 4 (“very often”). A total score was calculated with a possible range of 0 to 20. Sum scores of ≥ 7 indicate a problematic use of the internet.

Stress. Stress was assessed by a single-item-question [46]: “Stress is a state in which a person feels tense, restless, nervous, or anxious, or is unable to sleep at night due to disturbing thoughts. How much do you currently feel this type of stress?” Response options ranged from 1 (“not at all strong”) to 5 (“very strong”).

Social competencies. Based on the Assertion Inventory [47], eight items measured social competence in approaching others, expressing needs, resisting group pressure and standing up for oneself. Response options ranged from 1 (“very uncertain”) to 5 (“very certain”). A sum score ranging from 8 to 40 was calculated, with higher values indicating higher social

competence.

Individual risk and competence feedback, and module choice

The received traffic light feedback (green, yellow, red) for each behavior and the two chosen behavior modules were automatically recorded in the app for each student. For each module one dichotomous variable was created indicating whether it was chosen or not (see Interventions section for details).

Interventions

Development

Details on intervention development have been published elsewhere [38]. The coaching app "ready4life" was initially developed and evaluated in Switzerland aiming to prevent or reduce addictive behaviors and promote life skills among vocational students [48]. The latest version of "ready4life" was further enhanced for the current study. In particular, in addition to the four existing modules on alcohol, tobacco, stress management and social competencies, two new modules focusing on cannabis and social media/gaming were developed [38]. The adapted version of the "ready4life" app used in this study consisted of the app-based screening followed by the individual risk and competence feedback and the app-based coaching.

Efficacy

We have shown that the adapted version of "ready4life" is effective in reducing problematic internet use, stress, and tobacco use, as well as in improving social competencies over 12 months in this study's sample, which will be published elsewhere. Similarly, among Swiss vocational students, the six-module "ready4life" version significantly reduced at-risk drinking and problematic internet use over 6 months [9].

Individual risk and competence feedback

All study participants received in-app feedback on their individual risks and competencies in the form of a traffic light system for each assessed behavior of the in-app screening (Figure 2). Students received a green traffic light when they reported no or minor risks (e.g., did not smoke tobacco or use nicotine products in the last 30 days, perceived no or low stress), or a high competence (e.g., feeling secure in social situations) concerning the specific behavior. A yellow traffic light was given if students reported a moderate risk or competence (e.g., occasional tobacco smoking or nicotine products use in the last 30 days, perceived medium stress, feeling insecure in social situations), and a red traffic light if students reported a high risk or low competence (e.g., daily or almost daily tobacco smoking or nicotine products use in the last 30 days; perceived high stress, feeling highly insecure in social situations). For social media/gaming, students received a yellow traffic light feedback with a Short CIUS ≥ 7 [45], indicating a problematic internet use. The red traffic light uses a cut-off of ≥ 9 , which has been shown to have a higher specificity. Feedback on alcohol use was based on age- and gender-specific cut-offs derived from established guidelines on alcohol consumption [49]. Topic specific thresholds for receiving a green, yellow or red traffic light are displayed in Table S3 in Multimedia Appendix 2.

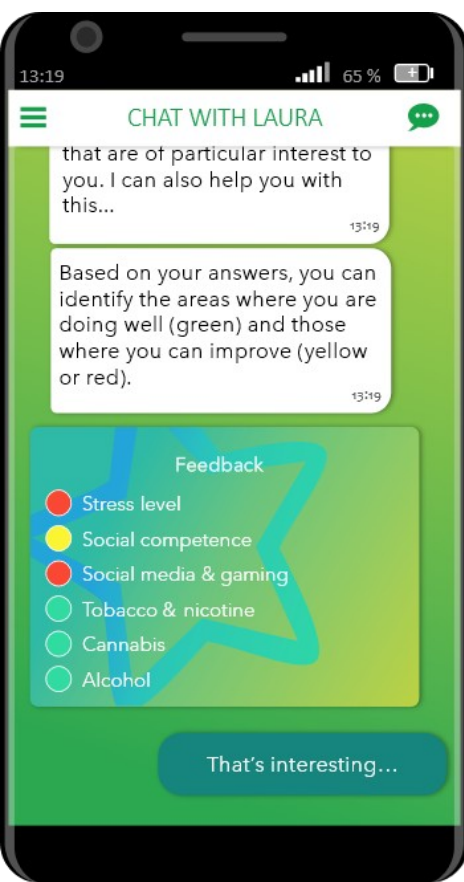


Figure 2. Individual risk and competence feedback provided by the app (English translation).

Module choice and app-based coaching

Students from the intervention group chose two out of six available behavior modules (alcohol, tobacco, cannabis, social media/gaming, stress, and social competencies), to be coached for 16 weeks via the “ready4life” app as described below. Because many vocational students engage in multiple addictive behaviors, addressing all at-risk behaviors could be overwhelming [24]. Therefore, the choice of modules was limited to two. Previous research suggests that this may optimize adherence to module recommendations [34] and improve intervention efficacy [24]. Given the comprehensive approach of the intervention, we expect that focusing on two selected modules will positively influence unselected topics by increasing students' motivation and self-efficacy to subsequently address other behaviors in the long term. In addition, we anticipate that changes in one behavior will positively influence other behaviors, e.g., by improving resilience factors such as social competence and stress management, which are known to protect against addiction [50, 51].

The students were advised to use their individual risk and competence feedback to guide their module choice (e.g., choosing modules with yellow or red traffic light feedback). However, module choice was completely self-determined including the option to choose modules that students received a green traffic light feedback for.

Six modules were available: alcohol, tobacco, cannabis, social media/gaming, stress and social competencies. Each module included eight weeks of coaching.

The two modules could not be started simultaneously. Instead, we chose to present the modules sequentially for the following reasons: (1) gradual introduction of behaviors may

reduce participants' burden and resistance, thereby improving engagement [23] and efficacy [52], (2) success in changing one behavior may increase students' confidence in tackling others subsequently, (3) this approach is consistent with goal-setting theory by breaking goals down into manageable steps [53], and (4) while simultaneous approaches may work well with populations with a high willingness to change multiple behaviors, a sequential approach may be particularly beneficial for populations with lower motivation, such as vocational students [5]. The two chosen modules were presented in random order.

The app-based coaching involved weekly chat interactions (once a week for about five minutes) over a four-month period. A rule-based conversational agent (i.e., without artificial intelligence) provided individualized feedback within the selected intervention modules. Chats also included media (videos, images, links), quizzes and contests. The content of the chats was constructed using the theoretical frameworks of social cognitive theory [54] and the Health Action Process Approach [55]. Each weekly session addressed specific behavioral constructs and goals, such as self-monitoring, risk perception, goal setting, or coping strategies. Detailed weekly content can be found in [38].

Pre-defined decision rules guided the chat interactions, with participant input during the conversations determining the subsequent responses of the conversational agent. For example, participants actively chose whether to receive additional information on certain topics, and the agent's responses varied depending on the accuracy of the participant's answers to quiz questions. Feedback was further tailored using participant data collected during the app-based screening. This data included demographic variables (e.g., age, gender), behavioral indicators (e.g., level of alcohol consumption, social competencies), and other variables such as motivation to change the targeted behavior, or perceived pros and cons of behavior change. In addition, progress in behavior change was assessed at weeks 8 and 16 to allow for ipsative feedback.

In addition to the weekly chats, users could self-initiate chat dialogues at any time. Push notifications (e.g., "Hi <nickname>") were used to inform the students of new chat content once a week. Further reminders were used for contest participation or if the app was not used for an extended period of time. Personal support in the form of an "ask-the-expert" function were integrated into the app.

Control group

After participating in the in-app screening and receiving the individual risk and competence feedback, students from the control group received a link to information on enhancing health behaviors only. However, they could access module choice and app-based coaching after 12 months.

Data Analyses

Description of the sample and prevention needs

Descriptive statistics were used to describe the sample, using *n* and percentages, means and standard deviation (SD) or median and Interquartile range (IQR) for highly skewed data. Prevention needs were described in terms of continuous addictive behaviors, stress and social competencies. Age, gender and educational track were analyzed as potential determinants of students' prevention needs using multiple multilevel regression models.

Individual risk and competence feedback

Percentages of students receiving green, yellow or red traffic light feedback were graphically

displayed for each behavior. Percentages of students showing different numbers of risks were reported according to yellow or red, and red traffic lights only.

Module choice

Of the 1286 participants randomized to the intervention group, n=20 had no access to the intervention due to mistyping of their class password, and further, n=30 did not choose modules. Thus, module choice was analyzed for 1236 intervention group participants.

Percentages of participants choosing each behavior module were graphically displayed for all intervention participants, intervention participants that received a yellow or red traffic light feedback for the respective behavior, and for intervention participants that received a red traffic light feedback. As only two out of six behavior modules could be chosen, percentages of intervention participants choosing each behavior module were also reported in dependence of the number of shown risks (one or two risks, or more than two risks).

Congruence between presented risk and module choice is measured by the proportion of students with a yellow/red traffic light feedback for a particular behavior (e.g. alcohol) among those who selected the corresponding behavior module (e.g. alcohol module).

Potential determinants of module choice

Multiple multilevel logistic regression analyses were conducted to module choice for each module separately (1= module chosen, 0= not chosen). Potential determinants included age, gender, educational track and the respective prevention need (i.e., problematic internet use was included as independent variable for modelling choice of the social media/gaming module, social competencies were included as independent variable when modelling choice of social competencies module, and so on.) All regression models included random intercepts on class level [56] to account for the clustered structure of the data. Intra-Class Correlation (ICC) was computed using an intercept-only model. ICCs express the percentage of total variance in the outcome (e.g., module choice) that is attributed to class membership [56]. Low n per class prohibited modelling of random intercepts on school level. Significance was set at $P<.05$. All statistical analyses were performed with Stata/Se 17.0.

Use of the German Classification of Occupations to analyze of determinants of prevention needs and module choice

A sensitivity analysis was performed using the German Classification of Occupations [42]. The German Classification of Occupations differs to ISCO-8 in that it classifies occupations based on the specific content, industry, or sector in which the work is performed compared to ISCO-8 that categorizes occupations based on the tasks, skills, and responsibilities associated with them. It considers the German labor market's unique characteristics and is more detailed in classifying occupations within the context of Germany.

Ethical Considerations

Ethical approval was granted by the ethics committees of the University of Lübeck (number 19-419) and the University Medicine Greifswald (BB 024/20). Digital informed consent was obtained from vocational students through the app, with no additional parental consent necessary in accordance with the EU General Data Protection Regulation. Underaged participants were encouraged to inform their parents or guardians about study participation.

Students completed the app-based screening anonymously. No names were collected; instead, students chose nicknames. Data protection was ensured through encrypted data transmission and storage within the app. For those who provided informed consent, research data was stored in a pseudonymized format, and contact information (email or phone number) was securely stored on a separate server. Participants were not offered any compensation other than the chance to win prizes.

Results

Sample description and prevention needs

Study participants are described in Table S4 in Multimedia Appendix 2. Within the total sample, the mean age was 19.7 (SD 3.7) years and 45.6% (1170/2568) were females. Most study participants (1648/2568, 64.2%) were in vocational training, followed by vocational grammar school (582/2568, 22.7%) and vocational preparation (282/2568, 11%). Within those students in vocational training, the most prevalent occupations were technicians and associate professionals (511/1648, 31%) as well as craft-rated trades workers (422/1648, 25.6%). The majority of students (1785/2568, 69.5%) were in their first or second year of education.

In terms of prevention needs, students on average perceived a moderate level of stress (M 3.29 SD 1.20 on a scale of 1 to 5), and reported a moderate level of social competencies (M 29.50 SD 4.69 on a scale of 8 to 40). The mean score for the Short CIUS was 9.14 (SD 4.18), which is above the threshold for problematic use of the internet. The median number of alcoholic standard drinks consumed per day was 0.20, with an IQR of 0.00 to 1.00. A proportion of 31.7% (814/2568) had used tobacco and 18.1% (464/2568) had used cannabis in the last month.

Of the total sample, 45.1% (1158/2568) of students used the app on Android and 54.9% (1410/2568) on iOS. Notably, iOS users reported significantly higher prevention needs across all behavioral domains except social competencies, where they had lower needs compared to Android users. Additionally, iOS users were more likely to select the tobacco module (data not shown).

When analyzing prevention needs as outcomes, ICCs were highest for alcohol consumption, indicating that 13.5% of the variance in the number of alcoholic standard drinks per day is attributable to class membership (Table S5 in Multimedia Appendix 2). Female gender was associated with significantly higher stress ($P<.001$; Coef 0.70, 95% CI 0.60-0.80), higher problematic internet use ($P<.001$; Coef 0.74, 95% CI 0.39-1.09), and lower social competencies ($P<.001$; Coef -2.27, 95% CI -2.67 to -1.88). In contrast, female gender was also associated with lower substance use (lower alcohol consumption: $P<.001$; Coef -0.40, 95% CI -0.55 to -0.24; lower odds of tobacco use: $P=.023$; OR 0.79, 95% CI 0.65-0.97 and lower odds of cannabis use: $P<.001$; OR 0.60, 95% CI 0.48-0.75), holding age and educational track constant.

Higher problematic internet use ($P<.001$; Coef -0.10, 95% CI -0.15 to -0.06) was significantly associated with younger age, while higher odds of tobacco use were associated with older age ($P=.006$; OR 1.04, 95% CI 1.01-1.06). Stress ($P=.064$; Coef 0.01, 95% CI -0.001 to 0.03), social competencies ($P=.073$; Coef 0.05, 95% CI -0.005 to 0.10), odds of cannabis use ($P=.180$; OR 1.02, 95% CI 0.99-1.05) and alcohol consumption ($P=.120$; Coef 0.01, 95% CI -0.004 to 0.03) were not significantly associated with age.

Wald tests indicate that social competencies ($P=.016$), problematic internet use ($P=0.002$), and the odds of tobacco use ($P<.001$) were significantly associated with educational track, after adjusting for gender and age, while perceived stress, odds of cannabis use, and alcohol consumption did not differ significantly between educational tracks. Clerical support workers

($P=.004$; Coef 1.10, 95% CI 0.36-1.84), service and sales workers ($P=.036$; Coef 0.79, 95% CI 0.05-1.52), students in vocational grammar school ($P=.005$; Coef 0.89, 95% CI 0.27-1.52) and students in vocational preparation ($P=.009$; Coef 1.02, 95% CI 0.26-1.79) reported significantly higher social competencies than the reference group of professionals / technicians and associate professionals. The other educational tracks did not differ significantly in their social competencies from each other (data not shown).

Problematic internet use was significantly lower among craft-related trades workers ($P=.011$; Coef -0.76, 95% CI -1.35 to -0.17), and the odds of tobacco use were significantly higher among service and sales workers ($P=.015$; OR 1.61, 95% CI 1.10-2.37) compared to the reference group.

Comparisons between the other educational tracks revealed that service and sales workers ($P=.034$; Coef -0.81, 95% CI -1.57 to -0.06) as well as craft-related trades workers / plant and machine operators and assemblers / elementary occupations ($P<.001$; Coef -1.26, 95% CI -1.93 to -0.58) reported significantly lower problematic internet use than clerical support workers, while students from vocational grammar school ($P=.001$; Coef 0.95, 95% CI 0.38 to 1.52) and vocational preparation ($P=.005$; Coef 1.00, 95% CI 0.30 to 1.69) reported significantly higher problematic internet use than craft-related trades workers / plant and machine operators and assemblers / elementary occupations. Vocational grammar school students also had lower odds of tobacco use than service and sales workers ($P<.001$; OR 0.46, 95% CI 0.31-0.68), craft-related trades workers / plant and machine operators and assemblers / elementary occupations ($P<.001$; OR 0.52, 95% CI 0.37-0.74), and vocational preparation ($P=.027$; OR 0.64, 95% CI 0.43-0.95). Finally, service and sales workers had a higher odds of tobacco use than clerical support workers ($P=.035$; OR 1.61, 95% CI 1.03-2.49).

Individual risk and competence feedback

Figure 3 shows the percentage of study participants who received a red, yellow or green traffic light feedback for each behavior. About two thirds of the study participants received either a red or yellow traffic light feedback for stress (1858/2568, 72.4%), social media/gaming (1828/2568, 71.2%) and/or alcohol (1672/2568, 65.1%). For tobacco, less than half (1133/2568, 44.1%) of the study participants received a red or yellow traffic light feedback, while for cannabis (673/2568, 26.2%) and social competencies (778/2568, 30.3%) only about a third received a red or yellow traffic light feedback.

On average, students received a red or a yellow traffic light feedback for 3.09 (SD 1.42) and a red traffic light feedback for 1.87 (SD 1.17) of the six behaviors. Only 2.7% (70/2568) of study participants received neither a red or yellow traffic light feedback, and 11.1% (286/2568) received no red traffic light feedback for any of the six behaviors (Table 1).

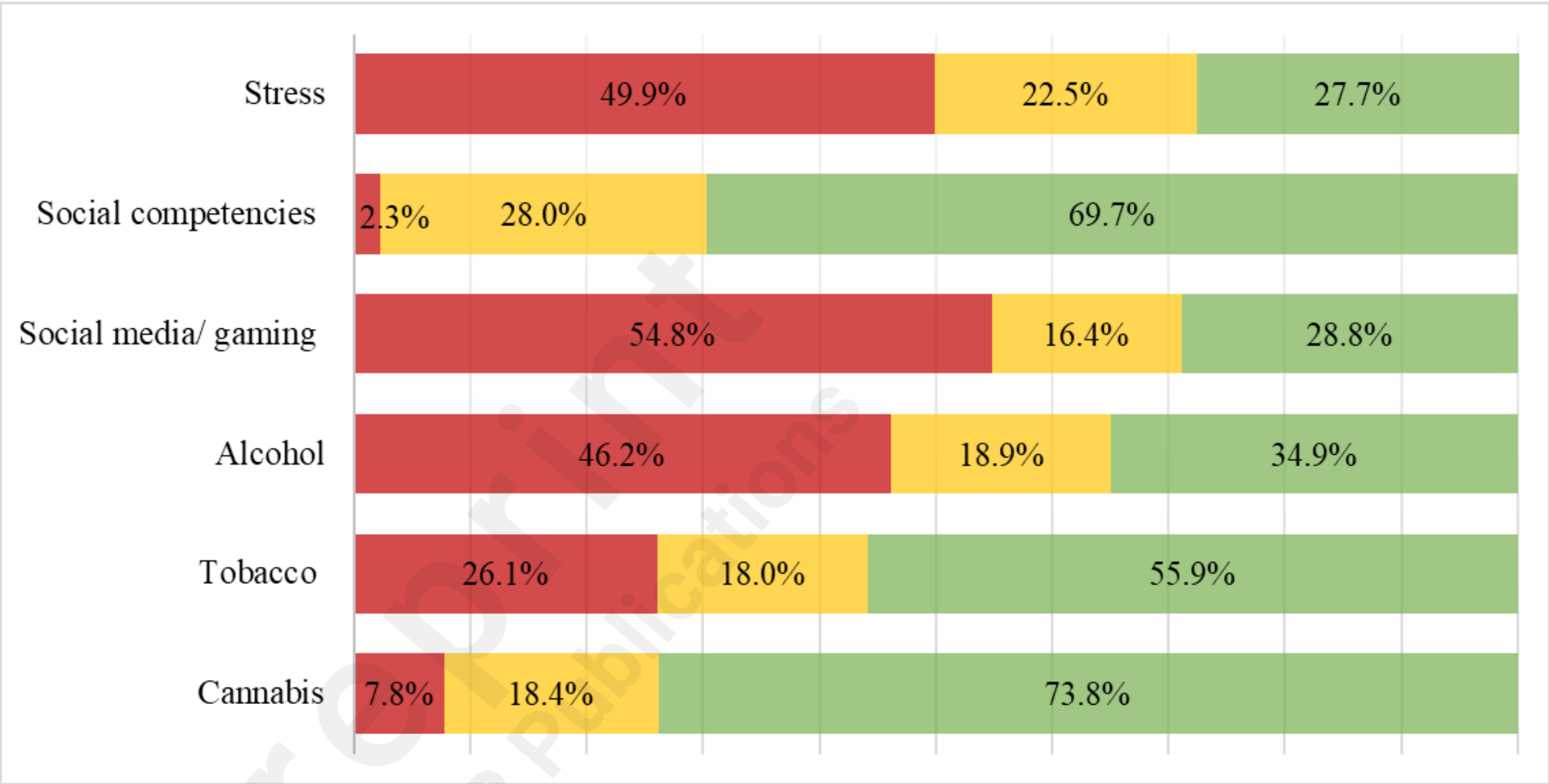


Figure 3. Percentage of students receiving a red, yellow or green traffic light feedback by topic (n=2568). ^a
^a Traffic lights were based on self-reported behaviors and gave advice for potential useful modules.

Table 1. Percentage of students showing different numbers of risks according to traffic light feedback (n=2568).^a

N (%) of students with							
Traffic light feedback	No risk	One risk	Two risks	Three risks	Four risks	Five risks	Six risks
Yellow /red	70 (2.7%)	285 (11.1%)	550 (21.4%)	637 (24.8%)	580 (22.6%)	350 (13.6%)	96 (3.7%)
Red only	286 (11.1%)	769 (30.0%)	783 (30.5%)	488 (19.0%)	204 (7.9%)	37 (1.4%)	1 (0.04%)

^a Traffic lights were based on self-reported behaviors and gave advice for potential useful modules.

Module choice

Among students who made a module choice, the most frequently chosen coaching topic was stress (818/1236, 66.2%), followed by social media/gaming (625/1236, 50.6%), alcohol (360/1236, 29.1%), social competencies (306/1236, 24.8%), tobacco (232/1236, 18.8%) and cannabis (131/1236, 10.6%). The frequency of module choice was higher among those students who had received a red or yellow traffic light feedback for the respective behavior compared to the total group (Figure 4). This trend was highest for stress with 80.3% (727/905) of students with yellow or red traffic light feedback and 87.7% (541/617) of students with red traffic light feedback choosing the stress module. The lowest choice rate was found for alcohol consumption, with even those with a red traffic light only 46.6% (274/588) choosing the alcohol module.

Table S6 in Multimedia Appendix 2 shows that among those students with only one or two yellow or red traffic light feedbacks, the choice rates for the recommended modules ranged from 68.4% to 97.6%. For those with more than two yellow or red traffic light feedbacks, the choice rates were much lower as students had to choose between several recommended modules. For example, choice rate for social media/gaming among those with more than two yellow or red traffic light feedbacks (193/206, 93.7%) was about 30% lower than among those with one or two yellow or red traffic light feedbacks (542/884, 61.3%). However, the n for some of the subsamples was rather small.

Most students chose modules that were congruent with their presented risks. For example, 88.9% (727/818) of the students who chose the stress module had a yellow or red traffic light feedback in this behavior area. The congruence rates for the other behaviors were as follows: social competencies 61.4% (188/306), social media/gaming 86.6% (541/625), alcohol 95.6% (344/360), tobacco 97.4% (226/232) and cannabis 89.3% (117/131).

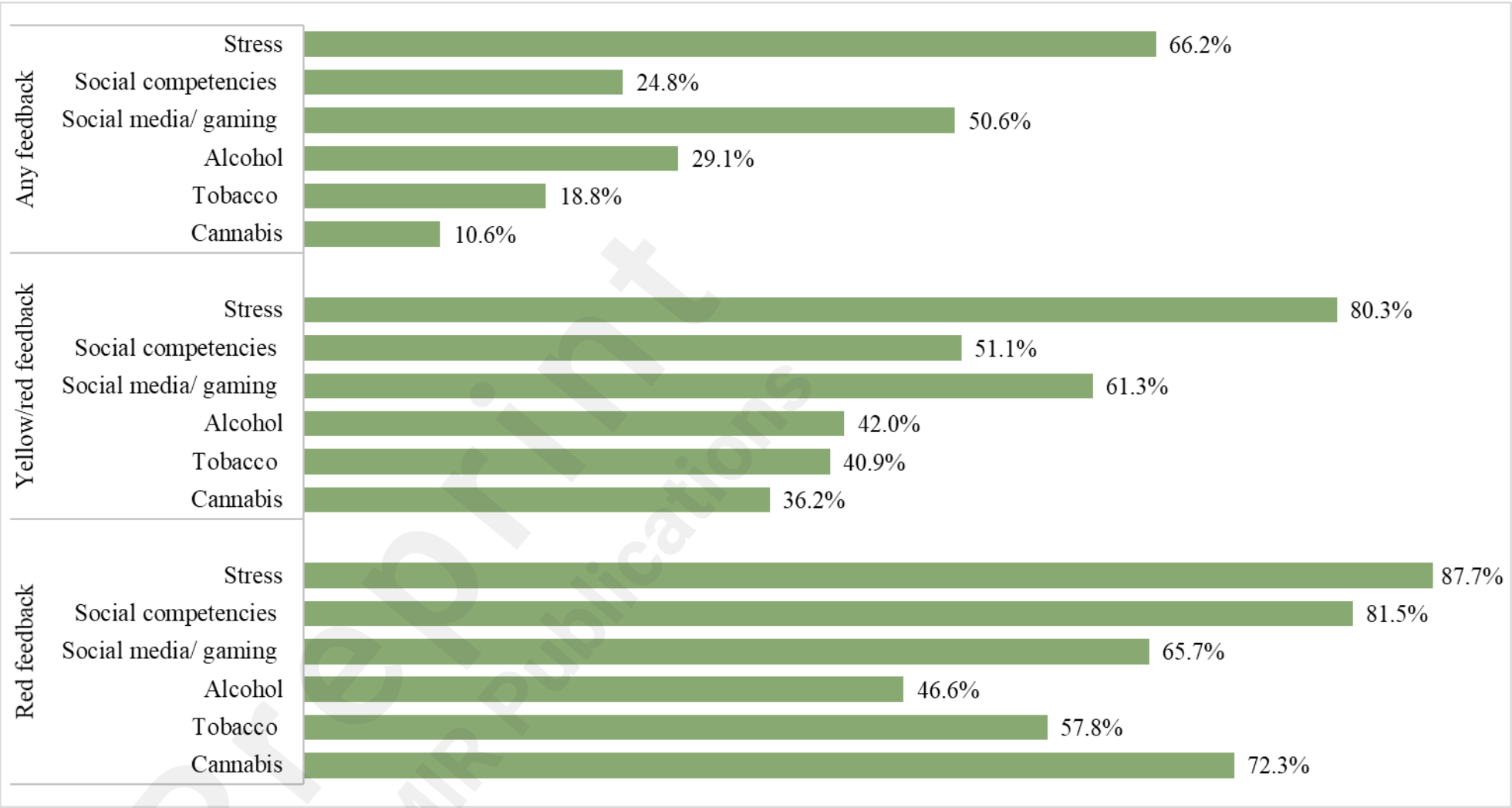


Figure 4. Frequency of participants' module choice by traffic light feedback (n=1236).^a
^a Traffic lights were based on self-reported behaviors and gave advice for potential useful modules; however, vocational students could freely select any two of the six modules.

Potential determinants of modules choice

Table S7 in Multimedia Appendix 2 shows the association of gender, age, educational track and prevention needs with module choice. The ICCs for the modules ranged from 2.1% to 11.0%, indicating a modest influence of class membership on module choice.

Females were significantly more likely to select the stress module than males ($P<.001$; OR 2.38, 95% CI 1.69-3.33), who were more likely to select social media/gaming ($P<.001$; OR 0.52, 95% CI 0.40-0.69), alcohol ($P<.001$; OR 0.50, 95% CI 0.37-0.67) and cannabis ($P<.001$; OR 0.37, 95% CI 0.21-0.63) than females, when holding age, education track and prevention need for the respective behavior constant. Males and females did not differ significantly with respect to their frequency of module choice for the tobacco ($P=.966$; OR 1.01, 95% CI 0.70-1.46) and social competence modules ($P=.438$; OR 1.13, 95% CI 0.83-1.54). Younger students were significantly more likely to choose the cannabis module ($P<.001$; OR 0.81, 95% CI 0.74-0.90), whereas there were no significant differences in module choice by age for the other five modules.

Although Wald tests did not reach significance, there were individual educational tracks that differed in their odds of choosing the social competencies, social media/gaming, alcohol, and the cannabis modules when compared to the reference category: Craft-related trades workers / plant and machine operators and assemblers / elementary occupations had a significantly lower likelihood of choosing social media/gaming when compared to the reference group of professionals / technicians and associate professionals ($P=.037$; OR 0.61, 95% CI 0.39-0.97), whereas the other tracks did not differ significantly from the reference in their likelihood of choosing social media/gaming. Clerical support workers ($P=.044$; OR 1.85, 95% CI 1.02-3.38), service and sales workers ($P=.049$; OR 1.77, 95% CI 1.00-3.15), and craft-related trades workers / plant and machine operators and assemblers / elementary occupations ($P=.012$; OR 1.98, 95% CI 1.16-3.38) were significantly more likely to choose alcohol compared to the reference group, whereas vocational grammar school ($P=.433$; OR 1.23, 95% CI 0.73-2.09) and vocational preparation ($P=.141$; OR 1.57, 95% CI 0.86-2.87) did not differ significantly from the reference group in their likelihood of choosing alcohol. Clerical support workers were most likely to select the cannabis module ($P=.012$; OR 3.66, 95% CI 1.33-10.03), and service and sales workers were least likely to select the social competencies module ($P=.015$; OR 0.51, 95% CI 0.30-0.88) when professionals / technicians and associate professionals were used as reference.

Prevention needs for each behavior were significantly related to the respective module choice, e.g., the higher the alcohol consumption, the more likely the alcohol module was chosen ($P<.001$; OR 1.31, 95% CI 1.21-1.43).

Use of the German Classification of Occupations to analyze of determinants of prevention needs and module choice

The prevalence of the occupational tracks based on the German classification of occupations is shown in Table S8 in Multimedia Appendix 2.

Wald tests indicate that only problematic internet use ($P=.002$) and the odds of tobacco use ($P=.002$) were significantly associated with educational track, after adjusting for gender and age (Table S9 in Multimedia Appendix 2). All educational tracks showed numerically higher problematic internet use compared to the reference category production / construction. However, these differences did not reach significance for tracks of natural science, geography and computer science ($P=.320$; Coef 0.44, 95% CI -

0.43 to 1.31) and trading, hotel and tourism ($P=.064$; Coef 0.65, 95% CI -0.04 to 1.34). The odds of tobacco use were significantly lower in natural science, geography and computer science ($P=.040$; OR 0.58, 95% CI 0.34-0.97), organization, accounting / media ($P=.021$; OR 0.59, 95% CI 0.38-0.92), and vocational grammar school ($P<.001$; OR 0.52, 95% CI 0.37-0.72) than in the reference category production / construction. Comparisons between the other educational tracks revealed that the odds of tobacco use were lower in vocational grammar school than in traffic, logistics, security and safety ($P=.017$; OR 0.51, 95% CI 0.30-0.89), trading, hotel and tourism ($P<.001$; OR 0.51, 95% CI 0.34-0.76), health, social affairs, teaching and education ($P=.033$; OR 0.65, 95% CI 0.44-0.97) and vocational preparation ($P=.027$; OR 0.64, 95% CI 0.43-0.95). Similarly, the odds were also lower in organization, accounting / media than in trading, hotel and tourism ($P=.030$; OR 0.58, 95% CI 0.35-0.95).

Choice of the social competencies module could not be modelled with multilevel logistic regression as the inclusion of the independent variables led to non-convergence of the model. Instead, a multiple logistic regression was used. Wald tests indicate that only the odds of choosing the social competencies ($P<.001$) and alcohol ($P=.011$) modules were significantly associated with educational track, after adjusting for gender, age, and the respective prevention needs (Table S10 in Multimedia Appendix 2). The social competencies module was chosen significantly more often by students from the natural science, geography and computer science track ($P<.001$; OR 3.40, 95% CI 1.71-6.73), and significantly less often chosen by students from the traffic, logistics, security and safety track ($P=.048$; OR 0.32, 95% CI 0.11-0.99) compared to the reference. Comparisons between the other educational tracks revealed that all educational tracks were significantly less likely to choose the social competencies module compared to students in natural science, geography and computer science. Students in organization, accounting / media and vocational grammar school were significantly more likely to choose the social competencies module than students in traffic, logistics, security and safety, as well as trading, hotel and tourism, while the other educational tracks did not differ significantly from each other in their odds of choosing the social competencies module (data not shown).

The alcohol module was selected significantly less often by students from the natural science, geography and computer science track ($P=.002$; OR 0.22, 95% CI 0.09-0.59) compared to the reference. The other educational tracks did not differ significantly in their odds of choosing the alcohol module from each other.

Although Wald tests did not reach significance, there were individual educational tracks that differed in their odds of choosing the stress, social media/gaming, and the cannabis modules when compared to the reference category: Stress was chosen significantly more often by students from the health, social affairs, teaching and education track ($P=.023$; OR 2.10, 95% CI 1.11-3.98), and social media/gaming was significantly more often chosen by students from the organization, accounting / media track ($P=.014$; OR 2.08, 95% CI 1.16-3.72). The cannabis module was chosen significantly more often by students from the traffic, logistics, security and safety track ($P=.005$; OR 4.41, 95% CI 1.54-11.13). The results for the other potential determinants in the multiple regression models are consistent with the main analysis.

Discussion

Principal Results

This study examined the prevention needs of German vocational students and their module choices within the app-based addiction prevention intervention "ready4life". Key findings included: (1) Prevention needs among vocational students were high. Almost 80% reported two or more risks according to a yellow or red traffic light feedback. The highest prevention needs were identified for stress, social media/gaming and alcohol. (2) In line with this, the most frequently chosen modules were stress and social media/gaming. (3) Alignment of module choice with the risk feedback received was high, especially for those with one or two risks. (4) Gender, age, educational background and the respective prevention needs were associated with module choice.

Interpretation of the Results and Comparison with Prior Work

Prevention needs

Our findings regarding the prevention needs related to substance and internet use are consistent with previous epidemiologic data showing a high prevalence of addictive behaviors among vocational students [5, 35, 57, 58], and higher levels of substance use among males compared to females and high levels of substance use among students in construction tracks [5, 57].

The proportions of students receiving green, yellow and red traffic light feedback, as well as the determinants of prevention needs are congruent with those found in the Swiss evaluation study of "ready4life" [17]. For example, Paz Castro et al. [17] also found that more than half (57.2%) of the students showed high-risk internet use, about a quarter (23.9%) showed high-risk tobacco use and less than 10% (9.6%) showed high-risk cannabis consumption. Only in the case of alcohol consumption, our study yielded about 12.5% more students with a high risk (red traffic light) than the study by Paz Castro et al. [17], probably due to a higher average age in our study. The high need for prevention in relation to stress is in line with previous research showing that vocational students have high levels of job-related stress and that this is associated with substance use [50]. In line with our study, Paz Castro et al. [17] found that females reported more stress and problematic internet use, but less social competencies and substance use than males, and that problematic internet use was associated with younger age, and tobacco use with older age. However, in contrast to our findings, Paz Castro et al. [17] also found slightly higher rates of risky alcohol use in females compared to males, and higher stress as well as higher rates of risky cannabis use in older compared to younger students. These differences may be explained by the different definitions of outcomes and/or potential determinants (e.g., continuous vs. categorical substance use or age) or different adjustment variables.

Comparisons of prevention needs according to educational track between these studies are difficult because different systems were used to classify occupations. However, both studies are consistent in that the area of construction /production were among those with the highest levels of tobacco use and those with the lowest levels of problematic internet use. In both studies, cannabis consumption did not differ by educational track.

Module choice

Stress and social media/gaming were the most frequently selected modules. This is congruent to the high proportion of students in our study with prevention needs in this area. The results regarding module choice were also congruent with the results of the

Swiss evaluation study of “ready4life” [17], which had the highest choice rates for stress and social media/gaming, as well.

Substance-related modules such as alcohol, tobacco and cannabis were less frequently chosen. This is consistent with previous multi-behavior interventions in adults showing that health-promoting behaviors such as physical activity and diet are preferred over substance-related modules [14, 15, 26, 28-31], but also in vocational students, showing that stress and non-substance-related behaviors such as social media use were chosen more often than substance-related behaviors such as smoking, alcohol or cannabis use [8, 17].

However, as it was intended, the traffic light feedback did affect module choice. When a module was recommended to the student, based on a moderate or high-risk present, the choice rates became much higher. This was particularly true for those students with only one or two risks. This is consistent with previous research showing that individuals are more likely to choose modules that are recommended to them based on their risk profile [17, 29]. This finding is not trivial because vocational students usually have low motivation to change addictive behaviors [5]. This could lead students to choose life-skills modules over addiction-related modules, even when given feedback on their high prevention needs in terms of addictive behaviors. Furthermore, in mobile substance use interventions, those with higher severity have sometimes shown lower engagement [59]. Finally, a similar intervention found that only half of the students chose modules congruent with their risks [60] when no feedback on prevention needs was provided.

In the current study, the proportion of students choosing modules congruent to their presented risk was higher (61-97%). However, due to the design of the study, we cannot exclude the possibility that module choice would have been the same without module recommendation. Future experimental research should compare the effects of a choice-based system with a similar automated referral system on non-usage attrition and intervention effects. Previous studies have not been adequately designed to draw valid conclusions on this [26, 28, 30].

Choice rate was lowest for the alcohol module. Allowing users to self-select their intervention topics may leave alcohol use largely unaddressed, especially if multiple risks were present. This is in line with data from adults showing that especially at-risk alcohol users with multiple risks tend to have lower motivation to change and less interest in behavioral feedback [61]. In addition to the low motivation to change, this finding could be explained by the stigmatization of alcohol dependence [62], which may lead to a preference for less stigmatized topics. Furthermore, given the low intention to change addictive behaviors among vocational students [5], offering the option to choose non-substance areas such as life skills might increase interest in participation and intervention use.

Potential determinants of module choice

There have been some studies in adults that have analyzed potential determinants of module choice in multiple-behavior interventions [14-16]. This is the first study to statistically investigate potential determinants of module choice in vocational students. The gender differences found in module choice are partly consistent with the prevalence differences between genders found in this study and other studies of vocational students [e.g., 17]. Furthermore, this is in line with a previous web-based intervention on multiple health promoting behaviors and substance use for adults showing higher interest of females in non-substance modules than males [15]. Specifically, as found in our study, in

Schulz et al. [15] the choice of the alcohol module was related to being male, whereas the choice of the tobacco module was not related to gender. Using the German classification of occupations, it is evident that differences in module choice in relation to educational track could be partly explained by the specific relevance of the modules for these tracks, e.g., high stress levels in the health and education sector [63] or the influence of cannabis use on safe driving in traffic and logistic sector. However, it is important to emphasize that associations between determinants and module choice exist independently of, or in addition to, the students' prevention need, and therefore may also indicate the accessibility of at-risk groups, highlighting the issue of social equity in mobile health interventions. Many mobile interventions fail to equitably engage subpopulations, particularly those with lower socio-economic status [36], which can exacerbate health disparities. In this study, gender disparities in module choice were evident. For example, males were less likely to choose the stress module, while females were less likely to choose modules on social media/gaming, alcohol, and cannabis. Research suggests that stress is more strongly associated with substance use among males [64], making them more likely to externalize stress through substances, particularly alcohol. Failure to address stress through appropriate modules could lead to the development or continuation of these harmful coping mechanisms among males. The lower likelihood of females choosing alcohol or cannabis modules compared to males is concerning given the increasing trends in substance use among females [65] and evidence that females are more vulnerable to negative consequences of substance use than males [66]. This disparity in module choice may reflect perceived gender norms or social stigma.

Interestingly, students from educational tracks typically associated with lower socio-economic status (e.g., clerical support workers, service and sales workers, craft-related trades workers, vocational preparation) were equally or even more likely to choose modules related to stress and substance use than their peers from educational tracks typically associated with higher socio-economic status (e.g., professionals, technicians, vocational grammar school). Thus, our mobile intervention approach had a positive impact on equity in that students with lower socio-economic status were more likely to respond to alcohol and cannabis modules than students with higher socio-economic status [67]. This is a significant finding given that previous research has consistently shown that individuals with lower socio-economic status tend to benefit less from mobile interventions due to lower participation and intervention use [36, 68, 69], despite higher rates of substance use [35], clustering of addictive behaviors [5], and greater substance-related harm [70]. Some lower status educational tracks were less likely to choose social competence or social media/gaming modules, such as service and sales workers or craft-related trades workers. While exposure to substance use modules may have an immediate positive impact on the health of these subgroups, not choosing social skills modules may limit students' opportunities to develop essential skills such as communication, conflict resolution, and emotional regulation, which are valuable in both professional and personal contexts.

The fact that a higher need for prevention increases the likelihood of choosing the respective module, is in line with the results of previous studies [8, 17]. Although, these studies did not statistically investigate potential determinants, higher prevention needs (indicated by a yellow or red traffic light) led to numerically higher module choices for these modules compared to the overall average.

Strengths

Strengths of the current study include (1) the focus on vocational students, an underserved group in mobile intervention research, (2) the use of a novel multi-

behavioral approach that combines life skills training with addressing multiple addictive behaviors, (3) the use of a facilitated access method that ensures a more representative sample compared to relying on online or media recruitment [40], (4) being the first study to statistically analyze the determinants of module choice among vocational students.

Limitations

The following limitations of this study should be considered when interpreting the results. First, the data may not be fully representative of German vocational students due to selection bias. E.g., additional analyses showed that male students and students from non-professional backgrounds were less likely to participate in this study. Furthermore, not all educational tracks were represented in the sample, e.g., agriculture, forestry, or military were not included. Second, data collection during the COVID-19 pandemic may have influenced participation willingness, addictive behaviors, or preferences for module selection. For example, gaming and social media use was elevated during the pandemic in adolescents [71]. Third, all assessments were based on self-report measures. Thus, there is the potential for over- or under-reporting, which could affect the accuracy of risk and competence feedback. Fourth, this study focused on module choice rather than module completion or frequency of app use. However, completion rates are likely to differ between modules [15, 31]. Fifth, we cannot exclude the possibility that the high interest in the stress module was partly triggered by the classes' introductions which had been largely focused on stress. Finally, the number of potential determinants assessed was limited. Other variables, such as students' personal values and goals, subjective importance of health, perceptions of social norms, or their migration background, could also be related to their prevention needs or module choices.

Conclusions

Our study supports the existing evidence that vocational students have high prevention needs in relation to addictive behaviors. An important finding was that the students' module choices were highly congruent with their identified prevention needs. This is important because intervention effects are likely to be higher when modules are chosen that are more relevant to the participant, e.g., when smokers choose to work on the smoking module [60]. Our findings also highlight that incorporating self-tailoring options into mobile health interventions works well to address multiple risks and different combinations of risks for vocational students. This is particularly important given that a high proportion of vocational students engage in multiple addictive behaviors and may not be able to address all of their issues at once. In terms of educational track, our mobile intervention approach was able to achieve a positive equity impact, i.e., those in tracks typically associated with lower socio-economic status were more likely to choose modules related to alcohol and cannabis. The identified module preferences may inform the further development of mobile interventions to improve adherence and effectiveness within specific subgroups. To promote more gender-equitable engagement, mobile interventions need to address disparities in module selection. Future interventions for vocational students could tailor module content or descriptions to gender to ensure that both genders engage with modules that meet their prevention needs. For example, framing stress management around work performance for males or linking substance use prevention to emotional well-being for females may increase engagement. Alternatively, embedding cross-links within modules,

such as mentioning substance use in life-skills modules, could promote more holistic behavior change across diverse groups. Future research should also investigate whether the choice of a particular module influences change in other unchosen modules, e.g., the effect of choosing the stress module on addictive behaviors.

Acknowledgements

This trial is funded by the German Federal Ministry of Health (Grant Number: ZMVI1-2519DSM217). The funding institution did not influence the design and conduct of the study; the management, analysis, or interpretation of data; or the preparation, review, or approval of the manuscript. We thank the Swiss Lung Association and the Swiss Research Institute for Public Health and Addiction (University of Zurich) for their contribution to program development and implementation, as well as Pathmate Technologies for the technical program development. We thank Dominique Brandt for her contributions to the development of the cannabis and internet use modules, the testing of the modified “ready4life” app, the development of the standard operating procedure (SOP), and the training of teachers to introduce the program to their classes. We appreciate all teachers, prevention staff and students for contributing to the study. The authors attest that there was no use of generative artificial intelligence (AI) technology in the generation of text, figures, or other informational content of this manuscript.

Authors' Contributions

D Guertler wrote the manuscript draft, conducted the statistical analysis, was responsible for the data management, data monitoring, data validation, data cleansing and the contribution to two newly developed “ready4life” modules, the testing of the modified “ready4life” app, the recruiting of vocational schools, and the presenting of the PARI study in vocational classes. **E Kraft** assisted with the classification of occupations for students in vocational training, follow-data collection and the preliminary statistical analysis. **D Bläsing** was responsible for the data management and programming of participant management software, follow-up reminder, and assessment. **A Möhring** contributed to study planning and the development of the two new “ready4life” modules as well as the testing of the modified “ready4life” app. **C Meyer** contributed to the study design, obtained the data gathering process, and follow-ups. **H Schmidt** was responsible for the recruiting of vocational schools and vocational students, and trained teachers to introduce the program to their classes. **F Rehbein** was responsible for conducting focus group discussions with students, teachers, and prevention experts, a phase 1 Delphi study before modified the “ready4life” app, and the development of the standard operating procedures (SOPs) of implementation. **M Neumann** and **A Dreißigacker** were involved in the recruitment of vocational schools and vocational students, and trained teachers to introduce the program to their classes. They also carried out the primary efficacy outcome analysis of the trial. **A Bischof** and **S Sürig** were involved in the development of the additional modules cannabis and internet use. **G Bischof** contributed to the study design and obtained the data gathering process. **L Hohls** was involved in the recruiting of vocational schools and vocational students. **S Wurm** provided supervision and resources for data management and follow-up assessments. **S Borgwardt** provided resources. **S Haug** was responsible for the development of the “ready4life” app. **H-J Rumpf** is the principal investigator of this study and was involved in all steps of the study process. **All authors** contributed to and have approved the final manuscript.

Data availability

The datasets and statistics generated during and/or analyzed during this study are available on reasonable request from the first-author.

Conflict of interest

S Haug played a leading role in the initial development of “ready4life”. **D Guertler, A Möhring, C Meyer, F Rehbein, A Bischof, S Sürig, H-J Rumpf** and **S Haug** were involved in the further development of the latest version of “ready4life” tested in this paper.

Abbreviations

Coef: Regression coefficient

OR: Odds Ratio

CI: Confidence interval

Multimedia Appendix 1

CONSORT-EHEALTH checklist

Multimedia Appendix 2

Supplementary Tables

Multimedia Appendix 3

STROBE checklist

Multimedia Appendix 4

TIDieR checklist

References

1. Orth B, Merkel C, Der Substanzkonsum Jugendlicher und junger Erwachsener in Deutschland. Ergebnisse des Alkoholsurveys 2021 zu Alkohol, Rauchen, Cannabis und Trends. BZgA-Forschungsbericht [The substance use of adolescents and young adults in Germany. Results of the Alcohol Survey 2021 on alcohol, smoking, cannabis and trends]. Köln: Bundeszentrale für Gesundheitliche Aufklärung; 2022. doi:<https://doi.org/10.17623/BZGA:Q3-ALKSY21-DE-1.0>
2. Wartberg L, Kriston L, Thomasius R. The prevalence and psychosocial correlates of internet gaming disorder: analysis in a nationally representative sample of 12-to 25-Year-Olds. *Deutsches Ärzteblatt International* 2017;114:419. doi:10.3238/arztebl.2017.0419
3. Onrust SA, Otten R, Lammers J, Smit F. School-based programmes to reduce and prevent substance use in different age groups: What works for whom? Systematic review and meta-regression analysis. *Clinical psychology review* 2016;44:45-59. doi:10.1016/j.cpr.2015.11.002
4. Montag J, Hanewinkel R, Morgenstern M. Verbreitung und Korrelate des Substanzkonsums unter 5 688 Auszubildenden an beruflichen Schulen [Prevalence and Correlates of Substance Use in 5 688 Vocational School Students]. *Das Gesundheitswesen* 2015;77:411-417. doi:10.1055/s-0034-1382043
5. Meyer C, Jähnel T, Freyer-Adam J, Ulbricht S, Hanke M, John U, Konsum von Glücksspielen, Medien, Cannabis, Alkohol und Tabak bei Jugendlichen und jungen Erwachsenen in beruflichen Schulen und Produktionsschulen Mecklenburg-Vorpommerns: Eine landesrepräsentative Querschnittserhebung [Gambling, media, cannabis, alcohol and tobacco consumption among adolescents and young adults in vocational schools and production schools in Mecklenburg-Vorpommern: A state-representative cross-sectional survey]. Greifswald: Institut für Sozialmedizin und Prävention; 2016.
6. Schmidt H, Brandt D, Meyer C, Bischof A, Bischof G, Trachte A, et al. Motivational brief interventions for adolescents and young adults with Internet use disorders: A randomized-controlled trial. *Journal of Behavioral Addictions* 2022;11:754-765. doi:<https://doi.org/10.1556/2006.2022.00049>
7. Atorkey P, Byaruhanga J, Paul C, Wiggers J, Bonevski B, Tzelepis F. Multiple health risk factors in vocational education students: A systematic review. *International journal of environmental research and public health* 2021;18:637. doi:10.3390/ijerph18020637
8. Pietsch B, Arnaud N, Lochbühler K, Rossa M, Kraus L, Gomes de Matos E, et al. Effects of an App-Based Intervention Program to Reduce Substance Use, Gambling, and Digital Media Use in Adolescents and Young Adults: A Multicenter, Cluster-Randomized Controlled Trial in Vocational Schools in Germany. *International Journal of Environmental Research and Public Health* 2023;20:1970. doi:10.3390/ijerph2003197
9. Haug S, Boumparis N, Wenger A, Schaub MP, Paz Castro R. Efficacy of a mobile app-based coaching program for addiction prevention among apprentices: A cluster-randomized controlled trial. *International Journal of Environmental Research and Public Health* 2022;19:15730. doi:10.3390/ijerph192315730
10. Krebs P, Prochaska JO, Rossi JS. A meta-analysis of computer-tailored interventions for health behavior change. *Preventive medicine* 2010;51:214-221. doi:10.1016/j.ypmed.2010.06.004
11. Lustria MLA, Cortese J, Noar SM, Glueckauf RL. Computer-tailored health interventions delivered over the Web: review and analysis of key components. *Patient*

- education and counseling 2009;74:156-173. doi:10.1016/j.pec.2008.08.023
12. Greaney ML, Puleo E, Bennett GG, Haines J, Viswanath K, Gillman MW, et al. Factors associated with choice of web or print intervention materials in the healthy directions 2 study. *Health education & behavior* 2014;41:52-62. doi:10.1177/1090198113486803
 13. Crutzen R, De Nooijer J, Candel MJ, De Vries NK. Adolescents who intend to change multiple health behaviours choose greater exposure to an internet-delivered intervention. *Journal of Health Psychology* 2008;13:906-911. doi:10.1177/1359105308095064
 14. Brouwer W, Oenema A, Raat H, Crutzen R, de Nooijer J, de Vries NK, Brug J. Characteristics of visitors and revisitors to an Internet-delivered computer-tailored lifestyle intervention implemented for use by the general public. *Health education research* 2010;25:585-595. doi:10.1093/her/cyp063
 15. Schulz DN, Kremers SP, De Vries H. Tailored eHealth lifestyle promotion: which behavioral modules do users prefer? *Journal of health communication* 2015;20:663-672. doi:10.1080/10810730.2015.1012243
 16. Coumans JM, Bolman CA, Oenema A, Lechner L. Predictors of self-determined module choice in a web-based computer-tailored diet and physical activity intervention: secondary analysis of data from a randomized controlled trial. *Journal of Medical Internet Research* 2020;22:e15024. doi:10.2196/15024
 17. Paz Castro R, Meyer C, Rumpf H-J, Schaub MP, Wenger A, Haug S. Präventionsbedarfe und-interessen bei Berufslernenden [Prevention needs and interests among vocational students]. *Prävention und Gesundheitsförderung* 2023;18:99-110. doi:https://doi.org/10.1007/s11553-022-00936-2
 18. Keller PA, Harlam B, Loewenstein G, Volpp KG. Enhanced active choice: A new method to motivate behavior change. *Journal of Consumer psychology* 2011;21:376-383. doi:10.1016/j.jcps.2011.06.003
 19. Kohl LF, Crutzen R, de Vries NK. Online prevention aimed at lifestyle behaviors: a systematic review of reviews. *Journal of medical Internet research* 2013;15:e146. doi:10.2196/jmir.2665
 20. Stassen G, Grieben C, Froböse I, Schaller A. Engagement with a web-based health promotion intervention among vocational school students: A secondary user and usage analysis. *International journal of environmental research and public health* 2020;17:2180. doi:https://doi.org/10.3390/ijerph17072180
 21. Ondersma SJ, Ellis JD, Resko SM, Grekin E. Technology-delivered interventions for substance use among adolescents. *Pediatric Clinics* 2019;66:1203-1215. doi:10.1016/j.pcl.2019.08.009
 22. Andersson G, Estling F, Jakobsson E, Cuijpers P, Carlbring P. Can the patient decide which modules to endorse? An open trial of tailored internet treatment of anxiety disorders. *Cognitive behaviour therapy* 2011;40:57-64. doi:10.1080/16506073.2010.529457
 23. Schulz DN, Schneider F, de Vries H, van Osch LA, van Nierop PW, Kremers SP. Program completion of a web-based tailored lifestyle intervention for adults: differences between a sequential and a simultaneous approach. *Journal of medical Internet research* 2012;14:e1968. doi:10.2196/jmir.1968
 24. Wilson K, Senay I, Durantini M, Sánchez F, Hennessy M, Spring B, Albarracín D. When it comes to lifestyle recommendations, more is sometimes less: a meta-analysis of theoretical assumptions underlying the effectiveness of interventions promoting multiple behavior domain change. *Psychological bulletin* 2015;141:474. doi:10.1037/a0038295
 25. Atorkey P, Paul C, Wiggers J, Bonevski B, Mitchell A, Tzelepis F. Intention to change

- multiple health risk behaviors and predictors of behavior change in vocational education students. *Journal of American college health* 2022;1-9. doi:10.1080/07448481.2022.2068960
26. Hughes SL, Seymour RB, Campbell RT, Shaw JW, Fabiyi C, Sokas R. Comparison of two health-promotion programs for older workers. *American Journal of Public Health* 2011;101:883-890. doi:10.2105/AJPH.2010.300082
 27. Campbell MK, Tessaro I, DeVellis B, Benedict S, Kelsey K, Belton L, Henriquez-Roldan C. Tailoring and targeting a worksite health promotion program to address multiple health behaviors among blue-collar women. *American Journal of Health Promotion* 2000;14:306-313. doi:10.4278/0890-1171-14.5.306
 28. Conner M, Wilding S, Prestwich A, Hutter R, Hurling R, Harreveld Fv, et al. Goal prioritization and behavior change: Evaluation of an intervention for multiple health behaviors. *Health Psychology* 2022;41:356. doi:10.1037/hea0001149
 29. Kanera IM, Willems RA, Bolman CA, Mesters I, Zambon V, Gijzen BC, Lechner L. Use and appreciation of a tailored self-management eHealth intervention for early cancer survivors: process evaluation of a randomized controlled trial. *Journal of Medical Internet Research* 2016;18:e229. doi:10.2196/jmir.5975
 30. Quintiliani LM, Campbell MK, Bowling JM, Steck S, Haines PS, DeVellis BM. Results of a randomized trial testing messages tailored to participant-selected topics among female college students: physical activity outcomes. *Journal of Physical Activity and Health* 2010;7:517-526. doi:10.1123/jpah.7.4.517
 31. Voncken-Brewster V, Amoureux M, de Vries H, Nagykaldi Z, Winkens B, van der Weijden T, Tange H. The impact of participant characteristics on use and satisfaction of a web-based computer-tailored chronic obstructive pulmonary disease self-management intervention: a process evaluation. *JMIR Formative Research* 2017;1:e6585. doi:10.2196/formative.6585
 32. Allegrante JP, Peterson JC, Boutin-Foster C, Ogedegbe G, Charlson ME. Multiple health-risk behavior in a chronic disease population: what behaviors do people choose to change? *Preventive Medicine* 2008;46:247-251. doi:10.1016/j.ypmed.2007.09.007
 33. Graham AK, Munson SA, Reddy M, Neubert SW, Green EA, Chang A, et al. Integrating user-centered design and behavioral science to design a mobile intervention for obesity and binge eating: mixed methods analysis. *JMIR formative research* 2021;5:e23809. doi:10.2196/23809
 34. Reinwand DA, Schulz DN, Crutzen R, Kremers SP, de Vries H. Who follows eHealth interventions as recommended? A study of participants' personal characteristics from the experimental arm of a randomized controlled trial. *Journal of medical Internet research* 2015;17:e3932. doi:10.2196/jmir.3932
 35. Lochbuehler K, Rossa M, Ebert C, Morgenstern M, Arnaud N, Kraus L. Substance use and the usage of social media, computer games, and gambling among apprentices at vocational schools. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz* 2024;67:465-474. doi:https://doi.org/10.1007/s00103-024-03854-0
 36. Jakob R, Harperink S, Rudolf AM, Fleisch E, Haug S, Mair JL, et al. Factors influencing adherence to mHealth apps for prevention or management of noncommunicable diseases: systematic review. *Journal of Medical Internet Research* 2022;24:e35371. doi:https://doi.org/10.2196/35371
 37. McHugh RK, Votaw VR, Sugarman DE, Greenfield SF. Sex and gender differences in substance use disorders. *Clinical psychology review* 2018;66:12-23. doi:10.1016/j.cpr.2017.10.012
 38. Schmidt H, Brandt D, Bischof A, Bischof G, Sürig S, Gürtler D, et al. App-Based Coaching to Prevent Addictive Behaviors among Young Adults. *Sucht* 2023;69:65-74. doi:https://doi.org/10.1024/0939-5911/a000811

39. Guertler D, Bläsing D, Moehring A, Meyer C, Brandt D, Schmidt H, et al. App-Based Addiction Prevention at German Vocational Schools: Implementation and Reach for a Cluster-Randomized Controlled Trial. *Prevention Science* 2024;1-12. doi:<https://doi.org/10.1007/s11121-024-01702-w>
40. Krause K, Guertler D, Moehring A, Batra A, Eck S, Rumpf H-J, et al. Feasibility and acceptability of an intervention providing computer-generated tailored feedback to target alcohol consumption and depressive symptoms in proactively recruited health care patients and reactively recruited media volunteers: results of a pilot study. *European addiction research* 2019;25:119-131. doi:<https://doi.org/10.1159/000499040>
41. Velicer WF, Prochaska JO, Fava JL, Rossi JS, Redding CA, Laforge RG, Robbins ML. Using the transtheoretical model for population-based approaches to health promotion and disease prevention. *Homeost Health Dis* 2000;40:174-195.
42. Bundesagentur für Arbeit, Klassifikation der Berufe 2010–überarbeitete Fassung 2020, Band 1: Systematischer und alphabetischer Teil mit Erläuterungen [Federal Employment Agency, Classification of Occupations 2010 - revised version 2020, Volume 1: Systematic and alphabetical part with explanations]. Nürnberg 2021. <https://statistik.arbeitsagentur.de/DE/Navigation/Grundlagen/Klassifikationen/Klassifikation-der-Berufe/KldB2010-Fassung2020/KldB2010-Fassung2020-Nav.html>
43. Ganzeboom HB, International standard classification of occupations ISCO-08 with ISEI-08 scores. 2010. http://www.harryganzeboom.nl/ISCO08/isco08_with_isei.pdf
44. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA, Project ACQI. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. *Arch Intern Med Res* 1998;158:1789-1795. doi:10.1001/archinte.158.16.1789
45. Besser B, Rumpf H-J, Bischof A, Meerkerk G-J, Higuchi S, Bischof G. Internet-related disorders: development of the short compulsive internet use scale. *Cyberpsychol Behav Soc Netw* 2017;20:709-717. doi:10.1089/cyber.2017.0260
46. Elo A-L, Leppänen A, Jahkola A. Validity of a single-item measure of stress symptoms. *Scand J Work Environ Health* 2003;444-451. doi:10.5271/sjweh.752
47. Gambrill ED, Richey CA. An assertion inventory for use in assessment and research. *Behavior therapy* 1975;6:550-561. doi:10.1016/S0005-7894(75)80013-X
48. Haug S, Castro RP, Wenger A, Schaub MP. Efficacy of a smartphone-based coaching program for addiction prevention among apprentices: study protocol of a cluster-randomised controlled trial. *BMC Public Health* 2020;20:1-8. doi:<https://doi.org/10.1186/s12889-020-09995-6>
49. EKAL EKfA. Botschaften für eine Orientierungshilfe zum Alkoholkonsum: Kurzversion. Eidgenössische Kommission für Alkoholfragen, Bern: <https://www.bag.admin.ch/dam/bag/de/dokumente/npp/alkohol/problemkonsum/ekal-orientierungshilfe-zum-alkoholkonsum.pdf.download.pdf/ekal-orientierungshilfe-zum-alkoholkonsum.pdf>. 2018;
50. Tomczyk S, Pedersen A, Hanewinkel R, Isensee B, Morgenstern M. Polysubstance use patterns and trajectories in vocational students—a latent transition analysis. *Addictive behaviors* 2016;58:136-141. doi:10.1016/j.addbeh.2016.02.027
51. de Jonge MC, Bukman AJ, van Leeuwen L, Onrust SA, Kleinjan M. Latent classes of substance use in young adults—A systematic review. *Substance Use & Misuse* 2022;57:769-785. doi:<https://doi.org/10.1080/10826084.2022.2040029>
52. Schulz DN, Kremers SP, Vandelandotte C, van Adrichem MJ, Schneider F, Candel MJ, de Vries H. Effects of a web-based tailored multiple-lifestyle intervention for adults: a two-year randomized controlled trial comparing sequential and simultaneous delivery modes. *Journal of medical Internet research* 2014;16:e26. doi:<https://doi.org/10.2196/jmir.3094>

53. Locke E, Latham G, *Goal-setting theory*, in *Organizational Behavior* 1. 2015, Routledge. p. 159-183.
54. Bandura A, Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ. Pearson Education; 1986. 013815614X
55. Schwarzer R. Self-regulatory Processes in the Adoption and Maintenance of Health Behaviors. *Journal of Health Psychology* 1999;4:115-127. doi:<https://doi.org/10.1177/13591053990040020>
56. Twisk JW, Applied multilevel analysis: a practical guide for medical researchers. Cambridge university press; 2006. 9780511610806
57. Hanke M, Ulbricht S, Freyer-Adam J, John U, Meyer C, Haug S. Tabakrauchen und Alkoholkonsum bei Auszubildenden an beruflichen Schulen in Vorpommern [Tobacco Smoking and Alcohol Consumption among Apprentices at Vocational Schools in West Pomerania, Germany]. *Das Gesundheitswesen* 2013;75:216-224. doi:10.1055/s-0032-1311621
58. Haug S, Schaub MP, Salis Gross C, John U, Meyer C. Predictors of hazardous drinking, tobacco smoking and physical inactivity in vocational school students. *BMC Public Health* 2013;13:1-9. doi:<https://doi.org/10.1186/1471-2458-13-475>
59. Paz Castro R, Haug S, Debelak R, Jakob R, Kowatsch T, Schaub MP. Engagement With a Mobile Phone-Based Life Skills Intervention for Adolescents and Its Association With Participant Characteristics and Outcomes: Tree-Based Analysis. *Journal of Medical Internet Research* 2022;24:e28638. doi:<https://doi.org/10.2196/28638>
60. Grahlher K, Morgenstern M, Pietsch B, Gomes de Matos E, Rossa M, Lochbühler K, et al. Mobile app intervention to reduce substance use, gambling, and digital media use in vocational school students: exploratory analysis of the intervention arm of a randomized controlled trial. *JMIR mHealth and uHealth* 2024;12:e51307. doi:<https://doi.org/10.2196/51307>
61. Spielmann M, Krolo-Wicovsky F, Tiede A, Krause K, Baumann S, Siewert-Markus U, et al. Patient motivation and preferences in changing co-occurring health risk behaviors in general hospital patients. *Patient Education and Counseling* 2023;114:107841. doi:10.1016/j.pec.2023.107841
62. Schomerus G, Lucht M, Holzinger A, Matschinger H, Carta MG, Angermeyer MC. The stigma of alcohol dependence compared with other mental disorders: a review of population studies. *Alcohol and alcoholism* 2011;46:105-112. doi:10.1093/alcalc/agq089
63. Johnson S, Cooper C, Cartwright S, Donald I, Taylor P, Millet C. The experience of work-related stress across occupations. *Journal of managerial psychology* 2005;20:178-187. doi:<https://doi.org/10.1108/02683940510579803>
64. Esper L, Furtado E. Gender differences and association between psychological stress and alcohol consumption: A systematic review. *J Alcohol Drug Depend* 2013;1:116-20. doi:<http://dx.doi.org/10.4172/jaldd.1000116>
65. Zakiniaez Y, Potenza MN. Gender-related differences in addiction: A review of human studies. *Current Opinion in Behavioral Sciences* 2018;23:171-175. doi:<https://doi.org/10.1016/j.cobeha.2018.08.004>
66. Nolen-Hoeksema S. Gender differences in risk factors and consequences for alcohol use and problems. *Clinical psychology review* 2004;24:981-1010. doi:<https://doi.org/10.1016/j.cpr.2004.08.003>
67. Jolles MP, Fort MP, Glasgow RE. Aligning the planning, development, and implementation of complex interventions to local contexts with an equity focus: application of the PRISM/RE-AIM Framework. *International Journal for Equity in Health* 2024;23:41. doi:<https://doi.org/10.1186/s12939-024-02130-6>

68. Littlejohn C. Does socio-economic status influence the acceptability of, attendance for, and outcome of, screening and brief interventions for alcohol misuse: a review. *Alcohol and Alcoholism* 2006;41:540-545. doi:<https://doi.org/10.1093/alcalc/agl053>
69. Castro RP, Haug S, Kowatsch T, Filler A, Schaub MP. Moderators of outcome in a technology-based intervention to prevent and reduce problem drinking among adolescents. *Addictive Behaviors* 2017;72:64-71. doi:10.1016/j.addbeh.2017.03.013
70. Katikireddi SV, Whitley E, Lewsey J, Gray L, Leyland AH. Socioeconomic status as an effect modifier of alcohol consumption and harm: analysis of linked cohort data. *The Lancet Public Health* 2017;2:e267-e276. doi:<http://dx.doi.org/10.1016/>
71. Paschke K, Austermann MI, Simon-Kutscher K, Thomasius R. Adolescent gaming and social media usage before and during the COVID-19 pandemic. *Sucht* 2021; doi:<https://doi.org/10.1024/0939-5911/a000694>

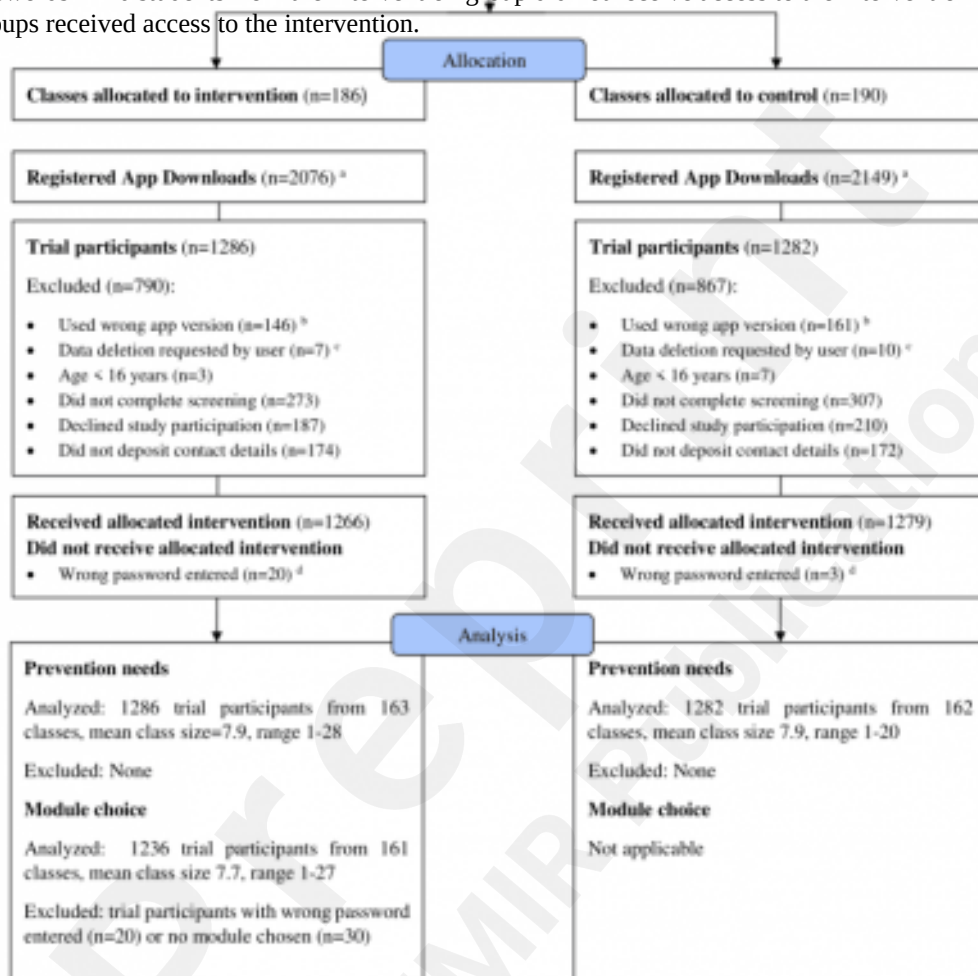


Supplementary Files

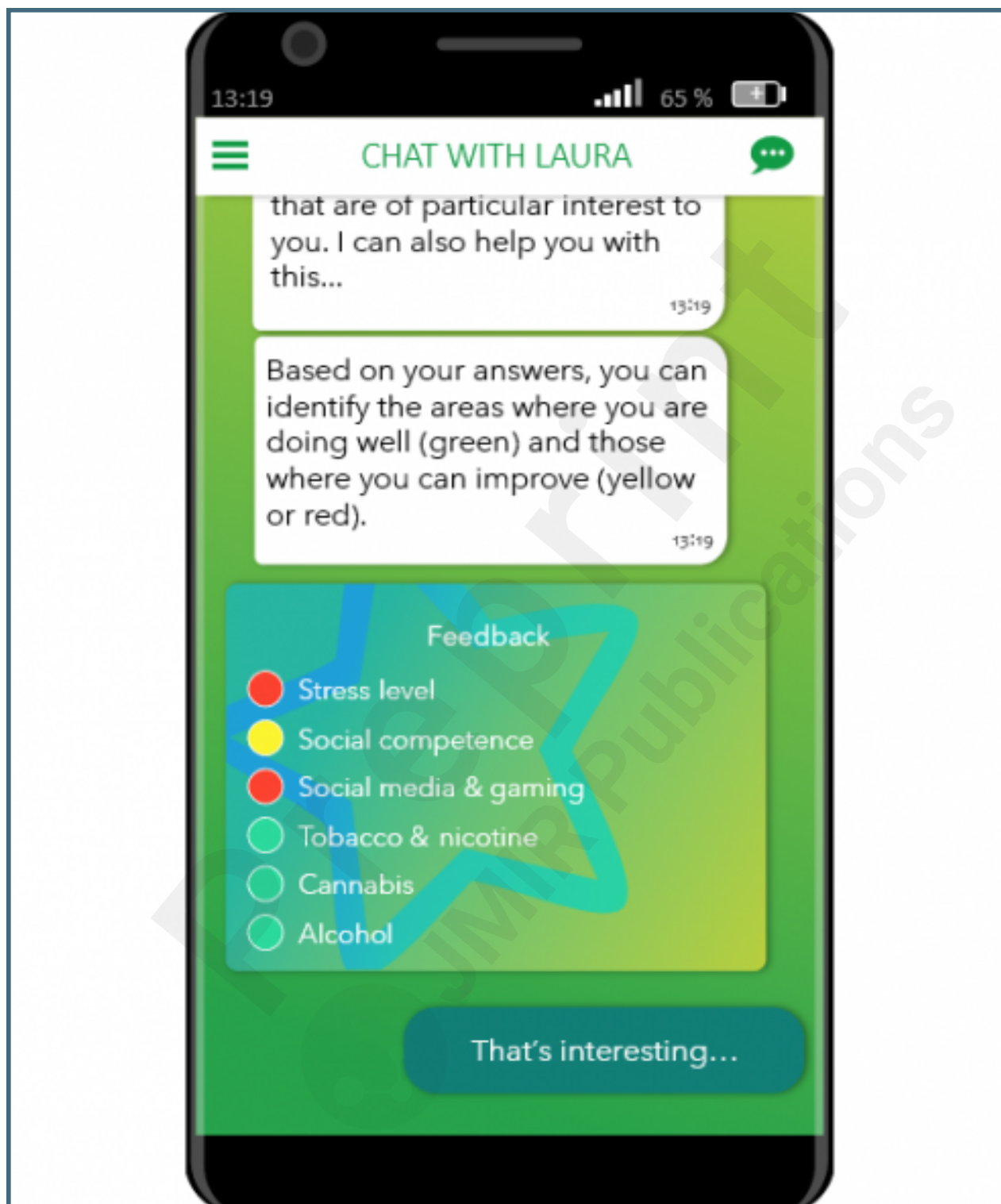
Figures



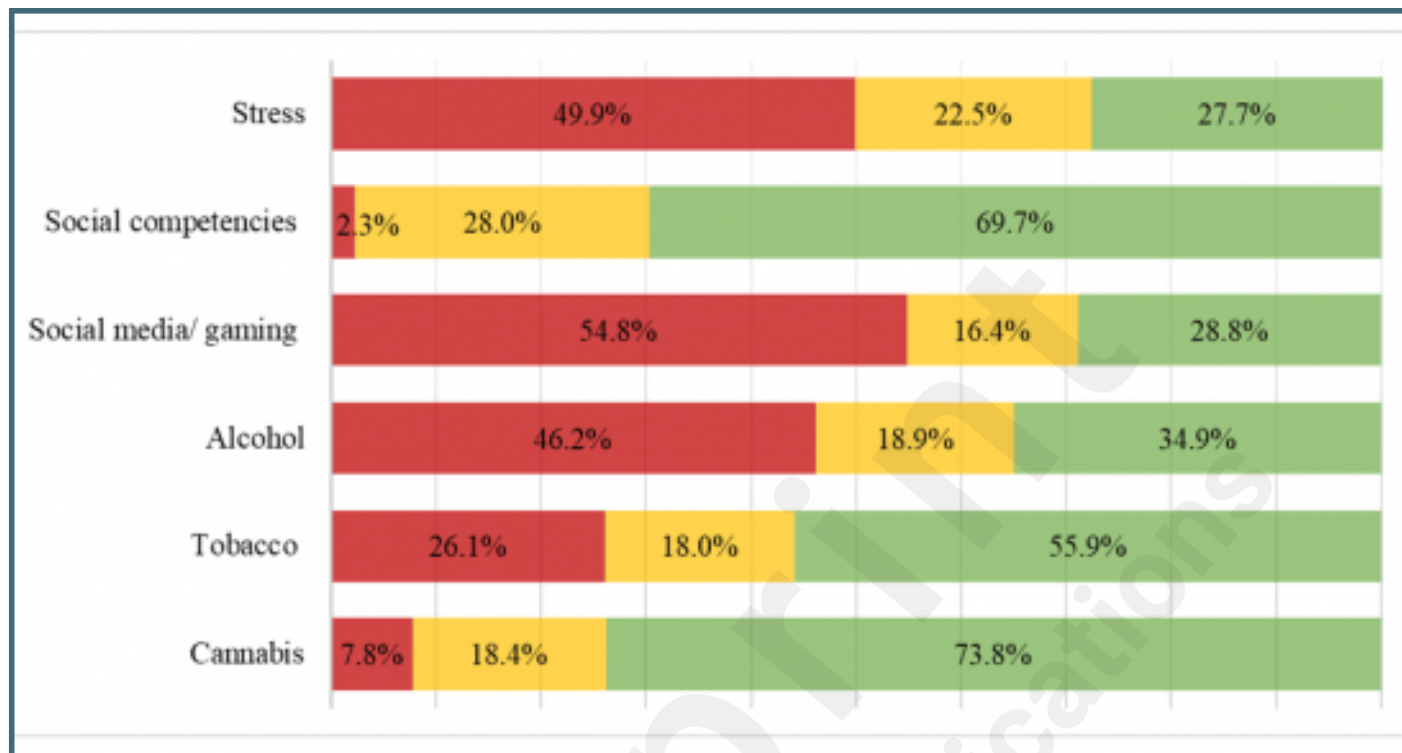
Flowchart of clusters and participants. a n=11 students were identified who had registered for the study twice; these have already been subtracted from the download count. b The app included multiple versions tailored to different countries or languages. Due to a technical issue between September 2, 2021, and December 10, 2021, 307 students were mistakenly directed to a different version of the app instead of the German version. As a result, these students used a version of the app that was not part of the current study, and informed consent could not be obtained from them. c App users were able to initiate the deletion of all data collected at any time point regardless of whether they just started the screening or provided informed consent and were using the intervention already. d Group allocation was performed on class level based on class specific passwords; due to mistyping of passwords n=20 students from the intervention group did not receive access to the intervention and n=3 students of the control groups received access to the intervention.



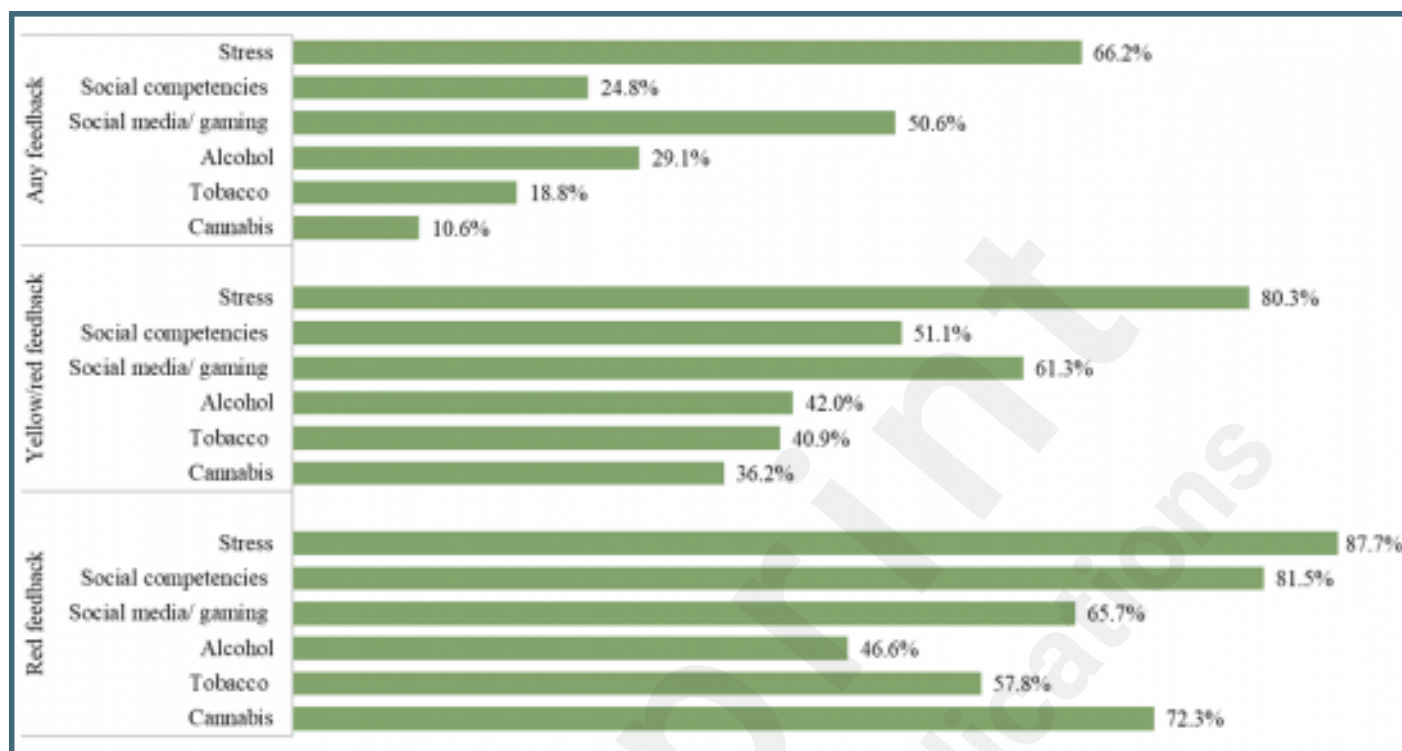
Individual risk and competence feedback provided by the app (English translation).



Percentage of students receiving a red, yellow or green traffic light feedback by topic (n=2568). Traffic lights were based on self-reported behaviors and gave advice for potential useful modules.



Frequency of participants' module choice by traffic light feedback (n=1236). Traffic lights were based on self-reported behaviors and gave advice for potential useful modules; however, vocational students could freely select any two of the six modules.



Multimedia Appendixes

Consort Ehealth checklist.

URL: <http://asset.jmir.pub/assets/28b2b56a046f3263bcb67cd41ed15025.pdf>

Supplementary Tables.

URL: <http://asset.jmir.pub/assets/c6769ff088ef93b3c2b21d66af0f1e60.doc>

Strobe Checklist.

URL: <http://asset.jmir.pub/assets/d4740d1ecd268ee6b718ff5e25adc54d.doc>

TIDierR Checklist.

URL: <http://asset.jmir.pub/assets/1c1d195617c188b66f4268765ff88aeb.doc>

