

Pre-Intervention Effects of a Community-Based Intervention Targeting Alcohol Use (LEF); The Role of Participatory Research and Publicity

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Abstract

This study explores the impact of the ‘pre-intervention effects’ of a community-based interventions. This refers to participatory research processes and parallel publicity in the media on changes in alcohol use and relevant mechanisms (rules and norms about alcohol, accessibility of alcohol in a formal setting) among adolescents before any intervention is implemented. In a quasi-experimental study, adolescent data were collected twice by means of self-report among adolescents living in two municipalities (control and experimental condition). Regression analysis showed pre-intervention main effects on adolescents’ perceived accessibility of alcohol in a formal setting. Moreover, among adolescents aged 15 years and older, the normative decline in strictness of rules and norms was less steep in the experimental condition compared to the control condition. Also, adolescents aged 14 years and younger in the experimental condition reported more weekly drinking compared to their peers in the control condition. No differential effects across gender were found.

To conclude, applying a co-creational approach in the development of an intervention, not only contributes to more effective interventions in the end, but involvement of and discussions in the community at the start of intervention planning are contributing to changes in targeted factors. This implies that public discussions about the development of intervention strategies should be considered as an essential feature of co-creation in community-based interventions.

Keywords: participatory research; pre-intervention; community-based intervention; alcohol

Introduction

Most people have their first experience with alcohol during adolescence. Several studies have shown that in recent years, the number of underage adolescents that drink alcohol, has declined on a global scale [1,2], including the Netherlands [3,4]. For example, among Dutch 12-year olds the prevalence of lifetime and monthly drinking decreased from respectively 71.1 and 30.9 percent in 2003 to 20.2 and 3.7 percent in 2017 [4]. Although alcohol use among adolescents has declined, the mean age for the onset of drinking is still relatively young: adolescents in The Netherlands are on average 13.3 years old when they start drinking alcohol [3]. Moreover, once started, adolescents drink at high levels: of those who have drunk alcohol in the past month, 71% have been involved in binge drinking (*drinking at least five glasses of alcohol during an occasion*) [3,4]. An early onset of alcohol use is an important risk factor for many negative consequences, like the development of other substance (ab)use [5], co-morbid mental health problems [6], more aggressive behavior [7] and a lower school engagement and poorer educational outcomes later in life [8]; therefore, prevention of early alcohol use in adolescents is crucial.

The development and implementation of interventions on alcohol use of adolescents is complex, as risk factors are multi-faceted, involving a combination of individual, social and environmental factors [9], with drinking behaviours influenced by factors from different levels, i.e. individual factors, parental and peer influence, and alcohol policies [10]. Moreover, the use of alcohol is often considered as a social activity, done together with peers [11,12]. Consequently, several studies showed that interventions are more effective in reducing adolescents' alcohol initiation and use when they're not only targeting the adolescents themselves [13], but also their parents [14, 15], entire family [16], or school [17]. Thus, considering that factors at multiple levels are relevant, multi-component interventions are

more effective than single-component interventions, and can therefore better contribute to reducing adolescents' alcohol use.

Community-based interventions are designed to address the complex interplay between individual behaviors and broader societal influences by involving the community itself and may be an effective way of reducing alcohol use and related harms. Traditional interventions that mainly focus on components at the community level (i.e. community-level interventions) include interventions such as warning and informing about the negative consequences of alcohol use. However, community-based interventions also aim to involve (part of) the community can correct mistaken perceptions about social norms, and can add three different types of intervention strategies: regulatory (e.g. strengthening alcohol policy enforcement), physical (e.g. reducing visibility of alcohol in public), and economic (e.g. making alcoholic beverages more expensive) [18]. Thus, the aim of community-based interventions is not to intervene on an individual level, but to bring stakeholders like policy-makers, educators, and regulators, together to influence this broader environment in which drinking frequently occurs [19].

Ensuring the appropriateness of community-based interventions to the local context requires the participation of local community actors (e.g. councilors, educators, parents, youth) who have intimate knowledge of the local context. Rationales for community participation in intervention development can be roughly split into two potentially complementary models: utilitarian model and empowerment model [20]. A utilitarian model of community participation posits that involvement of the community is essential because it will improve the effectiveness and sustainability of the resulting intervention because it will be better in line with the local context and have greater buy-in from local actors who were involved in the development. An empowerment model argues that community participation is an end in itself as it will directly contribute to community empowerment [21,22], which aligns

with the vision of health promotion as set out in the Ottawa Charter (World Health Organization; [23]).

Reviews of participatory and engaged research in community-based interventions have identified various program-related outcomes, included impacts on communities' health and social outcomes, community-wide behavioral and environmental changes, community empowerment, and reductions in social inequalities [24,25]. For example, once engaged, youth involved in interventions show a decrease in substance use [26]. These outcomes provide evidence to support a utilitarian model of community participation to improve health and social outcomes. These are promising outcomes, but a challenge remains in uncoupling the outcomes from the intervention and the contribution of the participatory research processes and its public discussions to the outcomes directly. This is largely due to the evaluation of interventions taken place towards the end of an intervention and evaluations narrowing defining the intervention only as the program that was delivered to the research participants, rather than encompassing the whole process from co-creation to evaluation. A recent realist review by Jagosh et al. [27] unpacked an array of outcomes that could be directly attributed to the participatory research processes, including capacity building, culturally appropriate research, productive conflict resolution and systems change. Whilst this review provides an good starting point in unpacking the benefits of participatory research more broadly, it leaves unanswered the question of how participatory research processes can directly improve the health and social outcomes that the developed intervention sets out to address.

A community-based intervention, referred to as LEF, applied a co-creational approach in the development of the intervention strategies. This period of development of intervention strategies took about six months, and received much attention in the media; e.g. via interviews in (online) local news papers and discussion in open civic meetings. The outcome itself (early

drinking) as well as the factors contributing to this, particularly the accessibility of alcohol, were a topic of discussion in the media, as well as among members of the community. Due to the fact that the PI of this study is part of the community, she was often (in)directly called upon the current issues of the program. A search in the online catalogues of a regional newspaper (Noordhollandsdagblad.nl) on the terms ‘alcohol [name municipality]’ shows that in the municipality of Edam-Volendam, in the year of the program (14/12/2017-13/12/2018) three times as many newspaper articles were published compared to a 1,5 times increase in the control municipality Enkhuizen. This increased attention in the media was an unintended consequence, emerging from the three steps in intervention development which wasn’t foreseen by the researchers. This led to question if this increased attention towards the drinking behaviors among youth in the development of the intervention may have affected both the outcomes itself and mechanisms, without any actual intervention strategy already implemented. We refer to these effects as the ‘pre-intervention’ effects; i.e. the effects of the development of an intervention while using co-creation, on relevant outcomes before intervention strategies are implemented. It is likely that this pre-intervention phase already has an impact on the targeted mechanisms and outcome of interest.

This study aims to address this gap by focusing on the process of participatory development of a community-based intervention aiming to reduce alcohol use amongst adolescents. The “intervention” for the context of the current study is the participatory research that was undertaken during the development of the community-based intervention LEF (Dutch translation of ‘courage’). It explores whether “pre-intervention effects” exists, referring to changes in alcohol use and relevant mechanisms amongst adolescents following the participatory research processes and parallel publicity in the media to develop the intervention, before the intervention is implemented. These ‘pre-intervention’ effects were examined across gender and age-groups as it is known that boys and older adolescents are

more likely to drink alcohol [4] and may therefore be less affected. This study will give insight into a potentially relevant phase in intervention research which may form the basis for enabling any change and therefore may impact the level of change in outcomes. The main aim of this study is to test to what extent these pre-intervention effects exist and contribute to change in targeted outcomes.

Methods

Procedure

Program LEF is a community-based intervention in the municipality of Edam-Volendam in the Netherlands that aims to delay the onset of alcohol use and reduce weekly drinking among youth. A quasi-experimental design is used including two municipalities; one experimental municipality and one control municipality. In February 2018, both public secondary schools within the municipality were willing to participate in the experimental condition, while another public secondary school within the fairly similar municipality of Enkhuizen participated in the control condition. The risk of spill-over effects is highly unlikely as the control school is situated more than 43km away. Though the experimental municipality is twice the size of the control municipality (36.000 versus 18.500 inhabitants respectively), in many other ways the municipalities are comparable in terms of percentage of 12-18 year old youth (9% versus 8%), 18+ alcohol users (29% versus 32%) and 18+ excessive alcohol users (7% in both municipalities).

Data were collected by trained research assistants in classrooms using online questionnaires, available on a secured website. Parents received a letter of consent, which informed them about the participation of the school in the program and they were given the opportunity to refuse participation of their child (1.13% refusal). Data were gathered in May/June 2018 (TN), and again six months later in November/December 2018 (T0) before any actual intervention was implemented. At TN the aim was to conduct a needs assessment

on which an explanatory model was designed (see Figure 1), while T0 functioned as the formal baseline assessment. The study was approved by the Ethics Review Board of the Faculty of Behavioral & Social Sciences at Utrecht University (FETC18-060).

Intervention: participatory development of a community-based intervention

Program LEF is a community-based intervention developed, implemented and evaluated in a municipality in The Netherlands. The developmental phase of LEF consisted of three steps (see Figure 2).

First, a needs assessment was conducted including semi-structured interviews with all relevant stakeholders (e.g. local politicians, parents, adolescents, youth, heads of school). In addition to these interviews, self-report questionnaires among youth were conducted. By collecting local data, LEF could be directly matched to the local target group and context to increase the likelihood to effectively change the desired outcomes [28,29]. Focusing on youth/parent engagement in this phase can also overcome potential obstacles perceived by youth to participate and thereby increase the relevance of and the participation of youth/parents further in the intervention when implemented [30]. Based on the results of both data sources, the outcome of the intervention was defined by the researcher and the municipality; delay the onset of drinking among adolescents.

Second, this data alongside (inter)national knowledge about important determinants of the onset of drinking were used to identify factors that were relevant for early drinking in this specific community [31]. This resulted in an explanatory model (Figure 1) including important and changeable factors within three domains, i.e. a) parents (e.g. rules about alcohol), b) youth (e.g. norms about alcohol), and c) repression (e.g. lower accessibility of alcohol).

Third, by mobilizing a local ‘taskforce’ (a varying group), input from members of the community was gathered (e.g. through discussion meetings per domain) to translate these relevant factors into intervention strategies [19]. In addition to inviting specific stakeholders directly to join the taskforce, participation in this taskforce was open to anyone interested. This co-creation approach, together with existing local intervention strategies, theories of behaviour change and other scientific knowledge, was used to develop the first intervention strategies targeting factors in the explanatory model.

Following the needs assessment, the social norms about drinking among adolescents, rule-setting by parents, and accessibility of alcohol, emerged as most important and changeable mechanisms that can influence the onset of alcohol use of adolescents.

Sample

Of all secondary schools, all classes expect for the exam classes participated in the study. A total of 2893 students were asked to participate in the study. Of these, 524 students did not participate due their parents’ refusal, their absence from school on the day of data collection (individual or whole class due to scheduling problems). In addition, students of the second school were only allowed to fill out the questionnaire outside school hours in their own time; 63 students out of 286 participated. This resulted in a sample eligible for analysis of $N=2,146$.

Socio-demographic characteristics at individual level for each condition and the total sample are presented in Table 1. The total sample had a mean age of 14.67 ($SD = 1.33$), consisting of 48.1% boys.

Loss to follow-up

Participants who did not participate in the follow-up ($N = 311$; 14%) differed from completers in terms of perceived accessibility of alcohol outside home ($t=2.28$, $p=.023$), age ($t=3.58$,

$p < .00$) and level of education ($t = 4.20$, $p < .00$). That is, adolescents who did not participate at follow-up reported a higher accessibility of alcohol outside home, were on average somewhat younger and more likely to be in lower level of education.

Measures

The main outcome measures were the mechanisms and outcome of the LEF program, i.e. norms about youth drinking, rules about alcohol, perceived accessibility of alcohol (home and café), and weekly drinking.

Norms about youth drinking reflect the acceptability of adolescents consuming alcohol in various situations (for example at home, and a party with friends). Participants were asked to what degree they thought it is acceptable for a person of the same age to drink alcohol in various situations (1 = 'not acceptable at all' to 5 = 'very acceptable'). The instrument is based on a Dutch translation of the 'Alcohol Use Norms Scale' [32], which was used in earlier research in the Netherlands [33]. Originally it contained seven items, in this study we used five items. A mean score was calculated, where a higher score indicated more positive norms about youth drinking. Cronbach's alpha was .92 at both waves.

Rules about alcohol reflect the degree of parental rule-setting regarding alcohol use as experienced by the adolescent [34]. Participants were asked to what extent their parents approve they (would) drink alcohol in various situations (for example at home with parents present, and at a party with friends). Originally it contained ten items, in this study we used five items, which were scored on a 5-point scale (1 = 'never' to 5 = 'always'). All items were recoded and a mean score was calculated, where a higher score indicated stricter parental rules about alcohol use. Cronbach's alphas were .94 (TN) and .92 (T0).

Perceived accessibility of alcohol reflect the degree of the perceived ease of obtaining alcohol in various situations. Participants were asked how easy they (think they would) get

alcohol in various situations on a 5-point scale (1 = 'very easy' to 5 = 'impossible').

Perceived accessibility is divided in *formal* (at a pub/café) and *informal* (mean score of three situations: at home from their parents, at a friend's home, and at a home of relatives;

Chronbach's alphas were .78 (TN) and .75 (T0)) accessibility of alcohol.

Weekly drinking was measured by using the quantity-frequency measure [35,36].

Frequency was measured by asking the number of week (Monday to Thursday) and weekend (Friday to Sunday) days the adolescents usually drink on weekly basis, while quantity was measured by asking how many glasses of alcohol the adolescents usually drinks on a typical week and weekend day they drink alcohol (7-point Likert scale; 0=I don't drink alcohol – 11=40 glasses or more) . The quantity-frequency was computed by calculating the products of the number of days and the number of glasses for weekly and weekend days separately. The sum of these scores were used where higher scores indicated more weekly drinking.

Age was measured by asking the age of the participant in years. The measure was dichotomized into two categories; 0=14 years or younger and 1=15 years and older.

Data Analysis

Missing data were estimated in Mplus using the Full Information Maximum Likelihood Estimation with Robust Standard Errors default setting (MLR), allowing information of all the 2,164 participants to be used for analysis [37]. Descriptive statistics and correlations were retrieved for the total group, for the experimental condition and control condition separately, and for each measurement occasion. We used Multiple Regression analysis to test the impact of the pre-intervention process as applied in LEF on the mechanisms and outcome at T0, i.e., *norms about youth drinking, rules about alcohol, accessibility of alcohol (informal and formal) and weekly drinking*. The direct effects were examined for the dichotomous intervention variable (0=control, 1= experimental) at baseline on the dependent variables at

follow-up, while controlling for the outcome variable at baseline, as well as age and gender. Since *weekly drinking* has a high variance relative to the mean, which indicates overdispersion, a zero-inflated negative binomial model was used [38]. The MLR estimator is robust to non-normality of the variables *norms about youth drinking* and *rules about alcohol* and is therefore used in the analysis. In line with Nieminen, Lehtiniemi, Vähäkangas, Huusko, and Rautio [39], we used the standardized β s as effect size indices, whereby $\beta < 0.2$ was considered a small, $0.2 < \beta < 0.5$ a moderate, and $\beta > 0.5$ a strong effect. To test moderation by age and gender, the interaction terms between the intervention condition*age (centered) and intervention condition*gender were added to the model separately.

Results

Main effects

The multiple regression analysis of the experimental condition at TN on the mechanisms at T0 (*norms about youth drinking, rules about alcohol, informal and formal accessibility of alcohol*) and outcome (*weekly drinking*) while controlling for the outcome at TN, show two significant effects (see Table 3). That is, adolescents in the experimental condition are significantly more likely to report a lower ease of access to alcohol in formal settings compared to adolescents in the control condition ($\beta=-0.05, p=.04$). Also, adolescents in the experimental condition are more likely to have a higher average week drinking level than adolescents in the control condition ($\beta=0.28, p<.00$). No other significant main effects of the intervention condition on mechanisms were found.

Moderation effects

The interaction between condition and gender revealed no significant interaction effects. This means that the effect of the LEF intervention on the mechanisms and outcome do not

significantly differ across gender. All but one (formal accessibility on condition*age) interactions of condition with age showed a significant effect on the mechanisms and outcome. That is, 15+ aged adolescents in the experimental condition are more likely to report less positive norms about youth' drinking ($\beta=-0.21, p<.00$) and stricter rules about alcohol ($\beta=0.16, p<.00$) compared to 15+ aged adolescents in the control condition. In addition, for older adolescents in the experimental condition, a lower ease of access of alcohol in the home situations was reported compared to adolescents in the control condition ($\beta=0.16, p<.001$). Last, the positive main effect of condition on weekly drinking only applies to adolescents aged 14 and younger ($\beta=-0.91, p<.00$).

Discussion

The current study demonstrated that applying a co-creational process and its subsequent discussions in the community (media), in the development of a complex community-based intervention yield effects on outcomes and mechanisms. That is, pre-intervention main effects were found on adolescents' perceived accessibility of alcohol in a formal setting. Moreover, among adolescents aged 15 years and older, the normative decline in strictness of rules and norms was less steep in the experimental condition compared to the control condition. Also, adolescents aged 14 years and younger in the experimental condition reported more weekly drinking compared to their peers in the control condition.

Although it is recognized that adolescence is typically known for its increase in involvement in risk behaviors, such as the use of alcohol [2,3], alongside the development of more positive norms and norms towards these behaviors when it becomes more salient [40], the current study demonstrated that this normative increase in alcohol use and its norms can be altered by applying a co-creation process where the public is involved in the development of an intervention and made visible through publicity in local media. Most likely, the increased attention in the media and public discussions about alcohol use among youth may

have contributed to these changes in norms and alcohol use. As suggested by social norms theories (e.g. [41, 42]), (perceived) norms are likely to affect behavior. Particularly within this particular community, drinking alcohol among youth is considered the norm, which makes it hard for adolescents to deviate from this norm by not drinking alcohol [43]. In their review on the role of social norms in anti-smoking campaigns, [44] argue that exposure to mass media messages “can directly encourage individuals to question existing norms and adopt new ones and can indirectly reduce social acceptability of smoking through public discussion” (p. 180). In this line, the increased attention in the media and public discussion about the drinking behavior of youth within the community, as was observed in LEF, could have caused 15+ adolescents to evaluate and adjust their norms about alcohol use. When adolescents are convinced that not all of their peers drink alcohol and drinking alcohol at their age is not socially accepted, this may have changed their norms about alcohol. The same principle may also have applied to parents. Social comparison theory [45] states that people evaluate themselves by comparing themselves with others, which implies that parents assess to what extent their parenting is adequate based on what parents perceive what other parents say and do [46]. If parents believe that other parents hold more permissive norms towards alcohol use of their children, they can experience pressure to conform to this perceived norm, and therefore become more lenient in their own parenting [46,47], for example by setting less strict rules about alcohol. The increased attention in the media and public discussion may have led to more interpersonal communication among parents about their parenting behaviors [48], and through these conversations, they got the opportunity to get more accurate perceptions about the norms regarding these behaviors [49]. When parents through these conversations learned that other parents in fact are less tolerant about alcohol use of their children than they thought, they can be strengthened in their own opinions and therefore can be empowered to set stricter rules themselves.

This might also have applied to other parental behaviors like the perceived reduction of the accessibility of alcohol at home. The home can be an important source of alcohol for youth [50], and multiple studies have shown that access to alcohol in the home and obtaining alcohol from parents can be linked to increased alcohol use, heavy episodic drinking and a higher risk of alcohol related harm (for a review, see [51]). Although these negative effects are well known, parents still “give their children alcohol to teach them how to drink responsibly and to prevent risky drinking with peers” ([52] p. 2). The increased attention in the media, public discussion, and interpersonal communication with other parents might have caused parents to question and adjust such views, resulting in reducing the accessibility of alcohol for their children in the informal context, i.e. at home.

Not only the accessibility of alcohol at home, but also the commercial (formal) accessibility of alcohol is a strong predictor of alcohol use [53]. Despite it is well known that a strict alcohol policy can help to reduce youth access to alcohol [54], compliance of these alcohol policies in the Netherlands is still low. A study by Van Hoof and Gosselt [55] showed that 100% percent of underage mystery shoppers succeed in buying alcohol at commercial places. Furthermore, twenty percent of 16-year olds who drink alcohol, declared they bought and consumed alcohol within hospitality services (e.g. pub or nightclub) at least once a month [3], which indicates that in the Netherlands alcohol is easily accessible for underage youth. The compliance to alcohol policy reflects broader societal drinking norms: communities with more conservative drinking norms may be more likely to enact and enforce comprehensive policies [54]. When it is socially accepted that underage youth drink alcohol, there will be less rigorous enforcement on underage drinking. However, the increased attention and public discussion may have altered this norm, and thereby made it easier to enforce the alcohol policy more rigorously. In addition, by increasing awareness and visibility of enforcement activities, youth might be deterred from buying and consuming alcohol in public places [54].

All in all, in the developmental phase of an intervention, where co-creation is applied and public discussions take place, the co-creation process can be considered as an intervention in itself that may alter some mechanisms of change before implementation of specific intervention strategies are being implemented.

Interestingly, the impact of the pre-intervention effects differ for younger and older adolescents. That is, the less steep decline in strictness of rules and norms were mostly changed among 15+ year old adolescents in the intervention condition; an age group most likely to be involved in drinking already [2]. Higher involvement in drinking behavior may make the discussion about this topic more applicable to this group which is therefore most likely to contribute to a change in norms and rules about alcohol. The lower applicability of the ongoing discussion about alcohol use among younger adolescents may also explain the impact of the experimental condition on more drinking among younger adolescents; their norms and rules were not changed by the intervention. Moreover, in the process of co-creation, most media attention and discussions among community members was given to the restrictive component of the intervention (accessibility of alcohol). As the restriction of accessibility to alcohol in the formal setting mostly applies to older adolescents (15 years and older), this may have contributed to the higher levels of drinking among particularly the younger group. The finding that the most favorable effects are found among 15+ adolescents underlines the importance of the applicability of messages for the target group.

Participatory research in community-based interventions is a complex process undertaken in a complex system. This study highlighted the concept of emergence within complex interventions, which means that components of the interventions will work together to create new and unexpected outcomes. That is, in the participatory development of LEF, the media attention that was generated following the start of the research was an unexpected outcome that led to a change in the context within which the resulting LEF intervention will

be implemented. This media attention contributed to an increase in conversations about alcohol use in the community and likely contributed to a change in norms among the adolescents surveyed. This study therefore highlights that when intervening in a complex system (i.e. community level interventions) that this might lead to unintended consequences and different outcomes than expected. This emphasizes the need for evaluation approaches that are timely and appropriate to capture these kinds of outcomes [56,57].

Strengths and Limitations

To our knowledge, this study is the first that revealed the contribution of co-creation and publicity of this process (i.e. pre-intervention effects) in community-based interventions to changes in outcomes and mechanisms. Though the study has several strengths, such as the quasi-experimental design with longitudinal data, the sample size, and innovativeness of the topic, several limitations should be discussed.

First, though it is highly likely that publicity in the co-creational process contributed to the changes in outcomes, this cannot be concluded for certain. It is possible that including community members in the development of interventions may also influence targeted factors even without public discussions. Future research should disentangle these aspects in the planning process of interventions.

Second, the extent to which the results of this study can be generalized to other contexts (municipalities or countries) is limited anyway [58], and even more so since the municipality of Edam-Volendam is a relatively close community, in which public discussions may be more important to foster change. The context wherein the intervention takes place should be taken into account [59]. Yet, specifically in a municipality like Edam-Volendam where conservative norms about youth drinking are adhered to, the need for community involvement can be made more visible in such communities.

Third, we assumed that the control municipality is similar to the experimental municipality. Yet, studies investigating community-based interventions use the community as the unity of intervention which increases the likelihood of having a comparison group that is less alike than assumed [58]. Studies including multiple municipalities in each condition and matching municipalities across conditions may be relevant to increase the likelihood of comparing similar groups of municipalities.

Conclusion

This study demonstrated that relevant changes in outcomes and mechanisms can already be achieved, purely by discussing the issue at hand and ways to deal with this with those involved. Previous research has demonstrated that involving the community in the entire process of intervention (from development to implementation and evaluation) more likely results in interventions matching the needs of the population within the community and thereby achieve more effectiveness [24-26]. In the current study, we showed that applying a co-creational approach in the development of an intervention, not only contributes to more effective interventions in the end, but that discussions in the community at the start of intervention planning are contributing to changes in targeted factors before any intervention is implemented. This implies that public discussions about the development of intervention strategies should be considered as an essential feature of co-creation in community-based interventions. Therefore, future community-based studies should search media attention to share information about the progress and aims of the to be developed intervention. This may be even more so for community-based targeting topics where social norms are highly relevant, such as substance use, where the broader environment should be influenced.

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Conflict of Interest

All author declare to have no conflict of interest.

References

1. ESPAD (2020). ESPAD Report 2019: Results from the European School Survey Project on Alcohol and Other Drugs. Luxembourg: Publications Office of the European Union.
2. Inchley J., Currie D., Budisavljevic S., Torsheim T., Jåstad A., Cosma A. ... Arnarsson A. (Eds.). (2020). Spotlight on adolescent health and well-being. Findings from the 2017/2018 Health Behaviour in School-aged Children (HBSC) survey in Europe and Canada. International report. Volume 1. Key findings. Copenhagen: WHO Regional Office for Europe.
3. Rombouts, M., Van Dorsselaer, S., Scheffers-van Schayk, T., Tuithof, M., Kleinjan, M., & Monshouwer, K. (2020). Jeugd en riskant gedrag 2019. Kerncijfers uit het Peilstationsonderzoek Scholieren. Utrecht: Trimbos-instituut.
4. Stevens G., Van Dorsselaer S., Boer M., De Roos S., Duinhof E., Ter Bogt T., ... De Looze M. (2018). HBSC 2017. Gezondheid en welzijn van jongeren in Nederland. Utrecht: Utrecht University.
5. Van Laar, M.W., Cruts, A.N.N., van Ooyen-Houben, M.M.J., Meijer, R.F. & Brunt, T. (2010). Nationale Drug Monitor Jaarbericht 2009. Utrecht: Trimbos-instituut.
6. Jeanblanc, J. (2015). Comorbidity Between Psychiatric Diseases and Alcohol Use Disorders: Impact of Adolescent Alcohol Consumption. *Current Addiction Reports*, 2, 293–301. <https://doi-org.proxy.library.uu.nl/10.1007/s40429-015-0076-5>
7. Jessor, R. (2014). Problem Behavior Theory: A half century of research on adolescent behavior and development. *The Developmental Science of Adolescence: History Through Autobiography*. 239-256.

8. Roebroek, L., & Koning, I. M. (2016). The reciprocal relation between adolescents' school engagement and alcohol consumption, and the role of parental support. *Prevention Science*, 17, 218-226. doi:10.1007/s11121-015-0598-z
9. Stockings, E., Bartlem, K., Hall, A., Hodder, R., Gilligan, C., Wiggers, J. ... Wolfenden, L. (2018). Whole-of-community interventions to reduce population-level harms arising from alcohol and other drug use: a systematic review and meta-analysis. *Addiction*, 113(11), 1984-2018. doi:10.1111/add.14277
10. Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge: Harvard University Press.
11. Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical Psychology Review*, 25(7), 841-861. doi:10.1016/j.cpr.2005.06.002
12. Steward, C., & Power, T. G. (2002). Identifying patterns of adolescent drinking: a tri-ethnic study. *Journal of Studies on Alcohol*, 63(2), 156-168. doi:10.15288/jsa.2002.63.156
13. Wold, B., & Mittelmark, M. B. (2018). Health-promotion research over three decades: the social-ecological model and challenges in implementation of interventions. *Scandinavian Journal of Public Health*, 46(20), 20-26. doi:10.1177/1403494817743893
14. Koning, I. M., Vollebergh, W. A. M., Smit, F., Verdurmen, J. E. E., Van den Eijnden, R. J. J.M., Ter Bogt, T. F. M., Stattin, H., & Engels, R. C. M. E. (2009). Preventing heavy alcohol use in adolescents (PAS): Cluster randomized trial of a parent and student intervention offered separately and simultaneously. *Addiction*, 104(10), 1669–1678. doi:10.1111/j.1360-0443.2009.02677.x

15. Koning, I. M., Van den Eijnden, R. J. J. M., Verdurmen, J. E. E., Engels, R. C. M. E., & Vollebergh, W. A. M. (2011). Long-term effects of a parents and student intervention on alcohol use in adolescents. *American Journal of Preventive Medicine*, 40, 541–547. doi:10.1016/j.amepre.2010.12.030
16. Smit, E., Verdurmen, J., Monshouwer, K., & Smit, F. (2008). Family interventions and their effect on adolescent alcohol use in general populations; a meta-analysis of randomized controlled trials. *Drug & Alcohol Dependence*, 97(3), 195–206. doi:10.1016/j.drugalcdep.2008.03.032
17. Foxcroft, D. R., & Tsertsvadze, A. (2011). Universal school- based prevention programs for alcohol misuse in young people. *Cochrane Database of Systematic Reviews*, 9. doi:10.1002/14651858.CD009113
18. EMCDDA (2018). Environmental substance use prevention interventions in Europe. Retrieved from https://www.emcdda.europa.eu/publications/technical-reports/environmental-substance-use-prevention-interventions-in-europe_en.
19. Stockings, E., Shakeshaft, A., & Farrell, M. (2018). Community approaches for reducing alcohol-related harms: an overview of intervention strategies, efficacy, and considerations for future research. *Current Addiction Reports*, 5, 274-286. doi:10.1007/s40429-018-0210-2
20. O'Mara-Eves, A., Brunton, G., McDaid, S., Oliver, S., Kavanagh, J., Jamal, F., ... Thomas, J. (2013). Community engagement to reduce inequalities in health: A systematic review, meta-analysis and economic analysis. *Public Health Research*, 1(4). doi:10.3310/phr01040
21. Gaventa, J., & Cornwall, A. (2006). Challenging the Boundaries of the Possible: Participation, Knowledge and Power. *IDS Bulletin*, 37(6), 122–128. doi:10.1111/j.1759-5436.2006.tb00329.x

22. Minkler, M., & Wallerstein, N. (2011). *Community-Based Participatory Research for Health: From Process to Outcomes*. San Francisco, CA: John Wiley & Sons.
23. World Health Organization. (1986). *Ottawa charter for health promotion*.
24. Milton, B., Attree, P., French, B., Povall, S., Whitehead, M., & Popay, J. (2012). The impact of community engagement on health and social outcomes: A systematic review. *Community Development Journal*, 47(3), 316–334. doi:10.1093/cdj/bsr043
25. O'Mara-Eves, A., Brunton, G., Oliver, S., Kavanagh, J., Jamal, F., & Thomas, J. (2015). The effectiveness of community engagement in public health interventions for disadvantaged groups: A meta-analysis. *BMC Public Health*, 15(1), 129–152. doi:10.1186/s12889-015-1352-y
26. McConnell, M., Memetovic, J., & Richardson, C. (2014). Coping style and substance use intention and behavior patterns in a cohort of BC adolescents. *Addictive Behaviors*, 39(10), 1394–1397. doi:10.1016/j.addbeh.2014.05.018
27. Jagosh, J., Macaulay, A. C., Pluye, P., Salsberg, J., Bush, P. L., Henderson, J., ... Greenhalgh, T. (2012). Uncovering the benefits of participatory research: Implications of a realist review for health research and practice. *The Milbank Quarterly*, 90(2), 311–346. doi:10.1111/j.1468-0009.2012.00665.x
28. Fagan, A. A., Arthur, M. W., Hanson, K., Briney, J. S., & Hawkins, J. D. (2011). Effects of Communities That Care on the Adoption and Implementation Fidelity of Evidence-Based Prevention Programs in Communities: Results from a Randomized Controlled Trial. *Prevention Science*, 12(3), 223–234. doi:10.1007/s11121-011-0226-5
29. Koning, I. M., De Kock, C., Van der Kreeft, P., Percy, A., Sanchez, Z. M., & Burkhart, G. (2020). Implementation of the Icelandic Prevention Model: a critical discussion of its worldwide transferability. *Drugs: Education, Prevention and Policy*.

doi:10.1080/09687637.2020.1863916

30. Sawyer, S. M., Afifi, R. A., Bearinger, L. H., Blakemore, S.-J., Dick, B., Ezeh, A. C., & Patton, G. C. (2012). Adolescence: A foundation for future health. *Lancet*, 379(9826), 1630–1640. doi:10.1016/S0140-6736(12)60072-5
31. Koning, I. M., & Van der Rijst, V. G. (2018). Programma LEF: het uitstellen van het beginnen met drinken onder minderjarige jongeren in Edam-Volendam. Rapportage probleemdefinitie. Received from <https://www.lef-edvo.nl/wp-content/uploads/2019/03/Bijlage-1-Onderzoeksrapport-programma-LEF.pdf>
32. Brody, G. H., Flor, D. L., Hollett-Wright, N., McCoy, J. K., & Donovan, J. (1999). Parent-child relationships, child temperament profiles and children's alcohol use norms. *Journal of Studies on Alcohol Supplement*, 13, 45–51.
doi:10.15288/jsas.1999.s13.45
33. Van der Vorst, H., Engels, R. C. M. E., Meeus, W., & Dekovic, M. (2006). The impact of alcohol-specific rules, parental norms about early drinking and parental alcohol use on adolescents' drinking behavior. *Journal of Child Psychology and Psychiatry*, 47, 1299–1306. doi:10.1111/j.1469-7610.2006.01680.x
34. Van der Vorst, H., Engels, R. C. M. E., Meeus, W., Dekovic, M., & Van Leeuwe, J. (2005). The role of alcohol-specific socialization in adolescents' drinking behaviour. *Addiction*, 100, 1464–1476. doi:10.1111/j.1360-0443.2005.01193.x
35. Engels, R. C. M. E., & Knibbe, R. A. (2000). Alcohol use and intimate relationships in adolescence: when love comes to town. *Addictive Behaviors*, 25, 435–439.
doi:10.1016/S0306-4603(98)00123-3
36. Engels, R. C. M. E., Knibbe, R. A., & Drop, M. J. (1999). Why do late adolescents drink at home? A study on the psychological well-being, social integration and drinking context. *Addiction Research*, 7, 31–46. doi:10.3109/16066359909004373

37. Muthén, L. K., & Muthén, B. O. (1998-2015). *Mplus User's Guide. Seventh Edition*. Los Angeles, CA: Muthén & Muthén.
38. Long, J. S. (1997). *Regression Models for Categorical and Limited Dependent Variables*, Thousand Oaks, CA: Sage Publications.
39. Nieminen P, Lehtiniemi H, Vähäkangas K, Huusko A, Rautio A. (2013). Standardised regression coefficient as an effect size index in summarising findings in epidemiological studies. *Epidemiological Biostatistic Public Health*;10:1–15.
40. Schulenberg, J. E., & Maggs, J. L. (2002). A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. *Journal of Studies on Alcohol and Drugs*, 14, 54-70. doi:10.15288/jsas.2002.s14.54
41. Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50, 179-211. doi:10.1016/0749-5978(91)90020-T
42. Rimal, R. N., & Real, K. (2005). How behaviors are influenced by perceived norms: a test of the theory of normative social behavior. *Communication Research*, 32(3), 389-414. doi:10.1177/0093650205275385
43. Sznitman, S. R., Kolobov, T., Ter Bogt, T., Kuntsche, E., Walsh, S. D., Boniel-Nissim, M., & Harel-Fisch, Y. (2013). Exploring substance use normalization among adolescents: a multilevel study in 35 countries. *Social Science & Medicine*, 97, 14-151.
44. Dono, J., Miller, C., Ettridge, K., & Wilson, C. (2020). The role of social norms in the relationship between anti-smoking advertising campaigns and smoking cessation: a scoping review. *Health Education Research*, 35(3), 179-194. doi:10.1093/her/cyaa008
45. Festinger, L. (1954). A theory of social comparison processes. *Human Relations*, 7, 117-140. doi:10.1177/001872675400700202

46. Linkenbach, J. W., Perkins, H. W., & DeJong, W. (2003). Parents' perceptions of parenting norms: Using the social norms approach to reinforce effective parenting. In H. W. Perkins (Ed.), *The social norms approach to preventing school and college age substance abuse: A handbook for educators, counselors, and clinicians* (pp. 247-258). San Francisco, CA: Jossey-Bass.
47. LaBrie, J. W., Hummer, J. F., Lac, A., Ehret, P. J., & Kenney, S. R. (2011). Parents know best, but are they accurate? Parental normative misperceptions and their relationship to students' alcohol-related outcomes. *Journal of Studies on Alcohol and Drugs*, 72(4), 521-529. doi:10.15288/jsad.2011.72.521.
48. Southwell, B. & Yzer, M. (2007). The Roles of Interpersonal Communication in Mass Media Campaigns. *Communication Yearbook*, 31, 419-462.
doi:10.1080/23808985.2007.11679072.
49. Jeong, M., & Bae, R. E. (2018). The effect of campaign-generated interpersonal communication on campaign-targeted health outcomes: a meta-analysis. *Health Communication*, 33(8), 988-1003. doi:10.1080/10410236.2017.1331184
50. Friese, B., Grube, J. W., & Moore, R. S. (2012). How parents of adolescents store and monitor alcohol in the home. *Journal of Primary Prevention*, 33, 79-83.
doi:10.1007/s10935-012-0267-y
51. Kaynak, Ö., Winters, K. C., Cacciola, J., Kirby, K. C., & Arria, A. M. (2014). Providing alcohol for underage youth: what messages should we be sending parents? *Journal of Studies on Alcohol and Drugs*, 75, 590-605. doi:10.15288/jsad.2014.75.590
52. Sharmin, S., Kypri, K., Khanam, M., Wadolowski, M., Bruno, R., & Mattick, R. P. (2017). Parental supply of alcohol in childhood and risky drinking in adolescence: systematic review and meta-analysis. *International Journal of Environmental Research*

and Public Health, 14, 287. doi:10.3390/ijerph14030287

doi:10.1016/j.socscimed.2013.08.038

53. Van Hoof, J. J., Van Zanten, E., & Van der Lely, N. (2015). Four years of reports of alcohol-related harm to pediatricians in the Netherlands. *Journal of Child & Adolescent Substance Abuse*, 24(4), 191-197. doi:10.1080/1067828X.2013.803943.
54. Paschall, M. J., Grube, J. W., Thomas, S., Cannon, C., & Treffers, R. (2012). Relationships between local enforcement, alcohol availability, drinking norms, and adolescent alcohol use in 50 Californian cities. *Journal of Studies on Alcohol and Drugs*, 73, 657-665. doi:10.15288/jsad.2012.73.657
55. Van Hoof, J. J., & Gosselt, J. F. (2013). Underage alcohol sales—it only takes minutes: a new approach to underage alcohol availability. *Journal of Studies on Alcohol and Drugs*, 74, 423–427. doi:10.15288/jsad.2013.74.423
56. Minary, L., Trompette, J., Kivits, J. et al. (2019). Which design to evaluate complex interventions? Toward a methodological framework through a systematic review. *BMC Medical Research & Methodology* 19, 92. <https://doi.org/10.1186/s12874-019-0736-6>
57. Pawson, R. (2013). *The Science of Evaluation: A Realist Manifesto*. Sage. <https://uk.sagepub.com/en-gb/eur/the-science-of-evaluation/book238842>
58. Kemm, J. (2006). The Limitations of ‘Evidence-Based’ Public Health. *Journal of Evaluation in Clinical Practice*. Special Issue: Evidence Based Medicine, 12(3), 319-324. <https://doi-org.proxy.library.uu.nl/10.1111/j.1365-2753.2006.00600.x>
59. Sharp, N.D., Pinerros, S.L, Hsu, C., Starks, H., Sales, A.E. (2004). A Qualitative Study to Identify Barriers and Facilitators to Implementation of Pilot Interventions in the Veterans Health Administration (VHA) Northwest Network. *World views on*

Evidence-Based Nursing, 1(2), 129-139. <https://doi.org/10.1111/j.1741-6787.2004.04023.x>

Table 1. *Descriptive Data on all Variables of Interest for the Control and Experimental Condition and Total Sample.*

	Control Condition (N = 1027)	Experimental condition (N = 1137)	Total (N=2146)
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Age (M,SD)	14.57(1.34)	14.75(1.32)	14.67 (1.33)
Gender (% boys)	49.9%	46.2%	
Norms about alcohol in youth T ₀ (M,SD)	2.00 (1.14)	2.22 (1.28)	2.12 (1.19)
Rules about alcohol T ₀ (M,SD)	3.90 (1.29)	3.66 (1.41)	3.78 (1.36)
Accessibility alcohol at home T ₀ (M,SD)	3.20 (1.21)	2.97 (1.34)	3.08 (1.29)
Accessibility alcohol at café T ₀ (M,SD)	3.84 (1.36)	3.48 (1.53)	3.65 (1.46)
Weekly drinking T ₀ (M,SD)	1.98 (5.17)	3.61 (8.37)	2.86 (7.13)
Norms about alcohol in youth T ₁ (M,SD)	1.93 (1.06)	2.04 (1.14)	1.99 (1.10)
Rules about alcohol T ₁ (M,SD)	4.05 (1.17)	3.93 (1.23)	3.99 (1.19)
Informal accessibility alcohol T ₁ (M,SD)	3.12 (1.13)	2.94 (1.25)	3.03 (1.19)
Formal accessibility alcohol T ₁ (M,SD)	3.78 (1.30)	3.48 (1.47)	3.63 (1.39)
Weekly drinking T ₁ (M,SD)	1.42 (4.96)	2.14 (4.97)	1.79 (4.97)

Table 2. *Correlations Between all Variables of Interest.*

	1	2	3	4	5	6	7	8	9	10	11
1. Age	X										
2. Gender	-.044*	X									
3. Norms about alcohol in youth T ₀	.574**	.101**	X								
4. Rules about alcohol T ₀	-.611**	.111*	-.701**	X							
5. Informal accessibility alcohol T ₀	-.536**	.023	.611**	.668**	X						
6. Formal accessibility alcohol T ₀	-.471**	.027	.457**	.468**	.599**	X					
7. Weekly drinking T ₀	.319**	-.012	.510**	.468**	.400**	.389**	X				
8. Norms about alcohol in youth T ₁	.459**	-.065*	.563**	.470**	.391**	.249**	.266**	X			
9. Rules about alcohol T ₁	-.498**	.038	.516**	.658**	.482**	.266**	.279**	.635**	X		
10. Informal accessibility alcohol T ₁	-.369**	-.033	.364**	.408**	.505**	.269**	.183**	.528**	.573**	X	
11. Formal accessibility alcohol T ₁	-.289**	-.001	.253**	.231**	.321**	.421**	.166**	.378**	.318**	.527**	X
12. Weekly drinking T ₁	.321**	-.003	.411**	-.386**	-.296**	-.250**	.373**	.449**	-.491**	-.328**	-.318*

Table 3. *Effects of Intervention Condition on Mechanisms (Norms about Youth, Rules about Alcohol, Accessibility of Alcohol) and Outcome (Weekly Drinking) at Follow-Up.*

Variable	Norms about Youth Drinking T ₁		Rules about Alcohol T ₁		Informal accessibility Alcohol T ₁		Formal accessibility Alcohol T ₁		Weekly Drinking T ₁	
	$\beta(SE)$	<i>p</i> -value	$\beta(SE)$	<i>p</i> -value	$\beta(SE)$	<i>p</i> -value	$\beta(SE)$	<i>p</i> -value	$\beta(SE)$	<i>p</i> -value
Age	0.37(.04)	.00	-0.33(.03)	.00	-0.27(.03)	.00	-0.21(.00)	.00	0.68(.09)	.00
Gender (0=girls, 1=boy)	-0.05(.02)	.03	0.02(.02)	.23	-0.02(.02)	.46	.00(.99)	.99	-0.04(.08)	.57
Outcome T ₀	0.43(.03)	.00	0.59(.03)	.00	0.39(.03)	.00	.39(.02)	.00	0.65(.10)	.00
Condition (1=experiment)	-0.02(.02)	.30	0.02(.02)	.43	-0.03(.02)	.20	-0.05(.04)	.04	0.28(.07)	.00

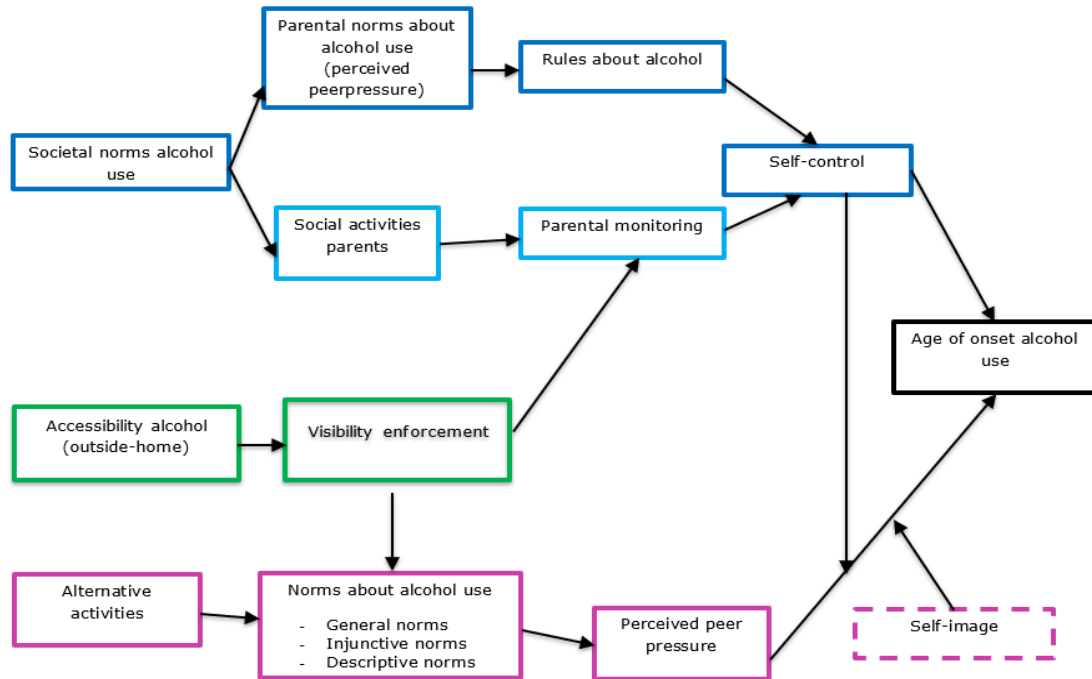


Figure 1. Explanatory Model including Important and Changeable Determinants of Behavior for Onset of Alcohol Use among Youth.

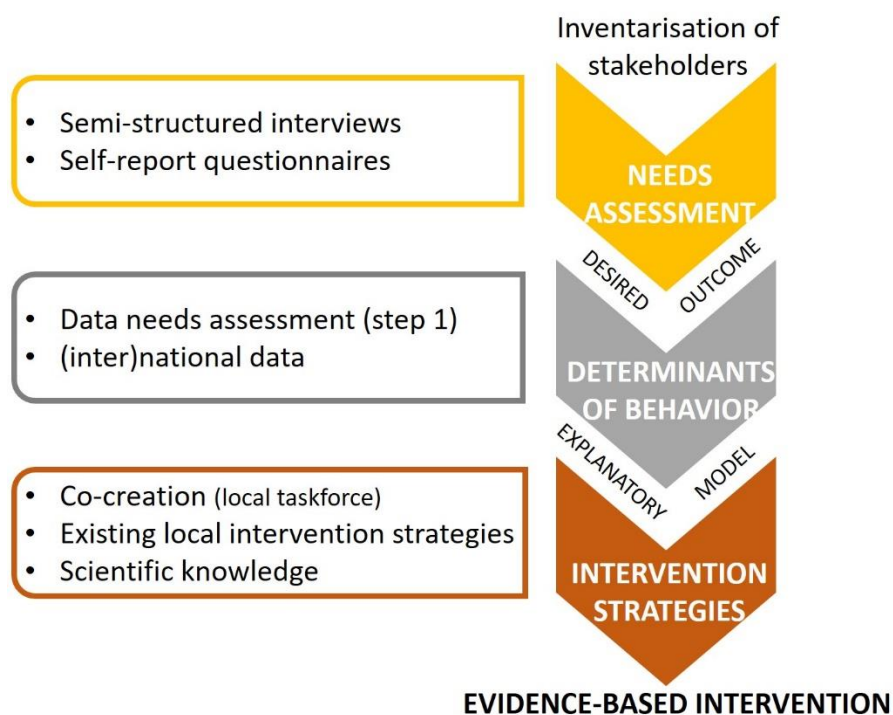


Figure 2. Three Steps Included in the Developmental Phase of the Community-Based Intervention LEF.

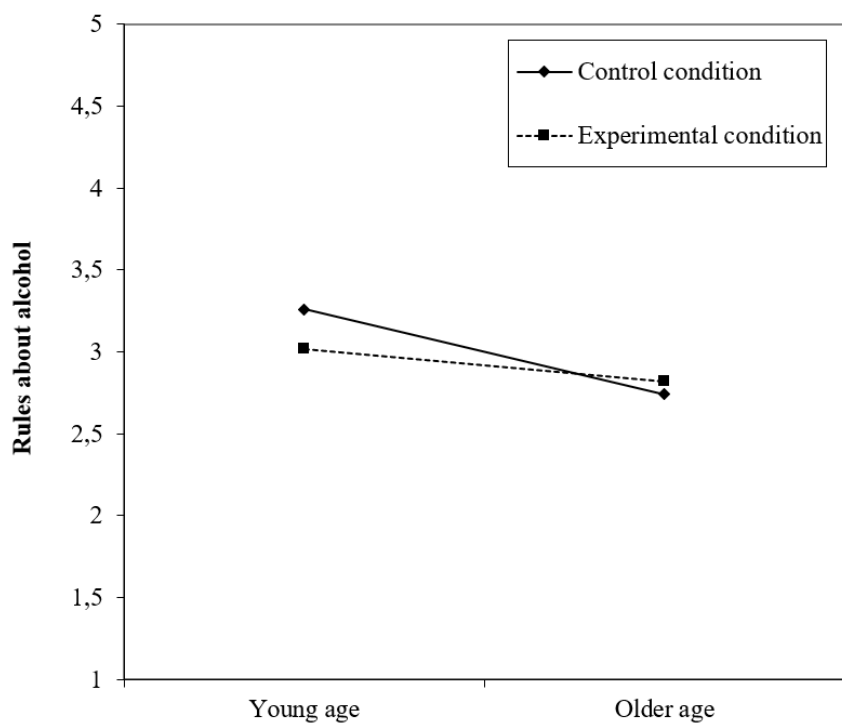


Figure 3. Visualization of the Interaction between Condition*Age on Rules about Alcohol.