

Does stage tailoring matter in brief alcohol interventions for job-seekers? A randomized controlled trial

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ABSTRACT

Aims To investigate whether or not a stage tailored intervention is more effective than a non-stage tailored intervention of the same intensity in reducing alcohol use among job-seekers with unhealthy alcohol use, and whether initial motivation to change is a moderator of efficacy. **Design** A three-group randomized controlled trial with 3-, 6- and 15-month follow-ups. **Setting** Three job agencies in Germany. **Participants** A total of 1243 job-seekers with unhealthy alcohol use were randomized to (i) stage tailored intervention based on the transtheoretical model of change (ST), (ii) non-stage tailored intervention based on the theory of planned behaviour (NST) and (iii) assessment only (controls). Participants received feedback letters and manuals at baseline and 3 months later. **Measurements** Piecewise latent growth models were calculated measuring change in 'alcohol use' from baseline to month 3 (active intervention phase) and from months 3 to 15 (post-intervention phase, primary outcome). Motivation to change was included as a 4-point continuous measure. **Findings** All groups reduced alcohol use from months 0 to 3 (controls: mean = -0.866, NST: mean = -0.883, ST: mean = -0.718, $P_s \leq 0.001$). Post-intervention (months 3–15), low-motivated individuals in the ST group showed a greater reduction than those in the control group ($\beta = 0.135$, $P = 0.039$, Cohen's $d = 0.42$) and in the NST group ($\beta = 0.180$, $P = 0.009$, Cohen's $d = 0.55$). In contrast, compared to the ST group ($\beta = 0.030$, $P = 0.361$), alcohol use decreased more strongly with higher initial motivation in the NST group ($\beta = -0.118$, $P = 0.010$). **Conclusions** Among job-seekers with high levels of alcohol consumption, an intervention tailored to motivational 'stage of change' was more effective than a non-stage tailored intervention for reducing alcohol use 15 months after baseline assessment in participants with low initial motivation to change.

Keywords Alcohol, computer-generated feedback, efficacy, intervention, job-seekers, motivation, randomized controlled trial, stage tailoring, theory of planned behaviour, transtheoretical model.

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INTRODUCTION

Two paths of how to understand and to support intentional behaviour change have been followed in the past three decades. The so-called stage models propose that behaviour change happens in distinct motivational stages, and that interventions are most effective when uniquely tailored to the stage of motivation. Representatives are the transtheoretical model of intentional behaviour change (TTM [1]), the precaution adoption approach [2] and the health action process approach [3]. In contrast, continuous theories provide a single predic-

tion equation expected to be valid for all individuals [4]. Representatives are the theory of planned behaviour (TPB [5]) and the health belief model [6,7].

The TTM [1] views behaviour change 'as nonlinear with periods of rapid change followed by periods of stability' ([8], p. 76). Individuals proceed through stages of change: from not thinking about change (pre-contemplation) to being ambivalent about change (contemplation), planning to change (preparation) and manifesting change (action) to maintaining achieved change (maintenance). Individuals apply processes of change to move through the stages; cognitive-affective

processes in early stages and behavioural processes in later stages [9]. Movement through the stages is associated with changes in decisional balance: that is, the weighing of pros and cons of changing [10], and self-efficacy: that is, the situation-specific belief in one's own ability to adhere to the target behaviour [11].

A major accomplishment of the TTM has been the provision of hypotheses on how to support individuals not ready to change move towards change. The authors [1] felt that health promotion programmes at the time had not adequately addressed these individuals. Evidence for the efficacy of stage tailored health behaviour change interventions vary among and within single behaviours [12–16]. For example, while one systematic review reports efficacy of stage tailored smoking interventions [13], another shows limited evidence for their efficacy [12]. A systematic review on stage tailored physical activity interventions supports their efficacy, provided that they apply all four dimensions of the TTM [17,18].

There is evidence that the efficacy of stage tailored interventions increases over time. A stage tailored smoking cessation intervention among general practice patients revealed growing point prevalence abstinence over 24 months compared to no intervention [19].

Furthermore, initial motivation appears to moderate the efficacy of motivation-enhancing interventions. For example, motivational interviewing [20,21] outperformed other alcohol interventions, particularly among individuals with rather low motivation to change. Among these individuals, greater alcohol reductions were found in comparison to skill-based counselling for heavy-drinking male general hospital in-patients [22], and in comparison to feedback only for young adult emergency patients [23]. Similar to (but not to confound with) TTM interventions, part of motivational interviewing is to determine where the client is in the process of change, in order to prevent asking too much of clients not yet ready to change.

Thoughtful criticism regarding the TTM focuses upon the stages of change, their operationalization and the limited evidence for their predictive value [4,24,25]. Until now there has been little convincing evidence that stage tailored interventions are more effective than non-stage tailored interventions. A match–mismatch experiment would provide the strongest test of a stage model [4,26]. Findings from these experiments are mixed [27], and systematic reviews [12,13,28,29] on the comparison of stage tailored and non-stage tailored interventions conclude that there is limited evidence for the superiority of stage tailoring, as also found by most recent randomized trials [30–33].

However, a few aspects should be considered: TTM interventions were often not based on all four TTM dimensions, and hence missed its multi-dimensional

nature [18], and the stage tailored and non-stage tailored interventions were often not of the same quality and intensity [13]. This is crucial, as theory-driven and individualized interventions have the best chances of being effective [34,35]. Furthermore, the majority of previous trials on comparative efficacy were conducted in the fields of smoking cessation and physical activity, and little is known with regard to alcohol use. Although alcohol use is among the three leading health risk behaviours responsible for global burden of disease [36], and despite its public health relevance, there is little knowledge about the effectiveness of alcohol screening and brief interventions (SBI) in non-medical and non-higher educational settings [37]. Intervention studies often do not reach those most in need, such as unemployed individuals [38]. The provision of SBI at job agencies would target a 'hard-to-reach' population with particularly high proportions of individuals in need of behaviour change interventions [39].

The aim of this study was to provide a fair test of the comparative efficacy of a stage tailored and a non-stage tailored intervention among job-seekers with unhealthy alcohol use. Both interventions were based on the most prominent representative models, the TTM [1] and the TPB [5], incorporated all theoretical dimensions, were individualized and of the same quality and intensity. It was expected that initial motivation moderates the interventions' efficacy, and that intervention effects increase over time.

METHODS

This study reports the main outcome results of the randomized controlled trial (RCT) 'Trial Of Proactive Alcohol interventions among job-Seekers' (TOPAS; ClinicalTrials.gov identifier: NCT01311245). The trial included three study arms and four measurement points. Trial participants provided informed consent. The ethics committee of the Ernst-Moritz-Arndt University Greifswald approved the study.

Sample recruitment

Between 7 July 2008 and 10 July 2009, three job agencies participated [39]. During opening hours, study assistants approached all 18–64-year-old job-seekers appearing in the waiting area to speak to a job agent. Those who agreed to participate in the self-administered screening answered questions on health behaviours using handheld computers. Individuals cognitively or physically incapable, already recruited during an earlier visit, with insufficient language or reading skills, and escorting individuals were excluded from the trial. Individuals who screened positive for unhealthy alcohol use

and negative for particularly severe alcohol problems were eligible and asked to participate in the RCT. Group assignment (one-third each) was conducted by the hand-held computers using a Java random generator; study staff were not involved. Baseline assessment was self-administered and computerized. Trial participants received a voucher of €10 by mail.

Based on a previous RCT using a proactively recruited sample [40], small intervention effects (Cohen's $d = 0.2$) regarding alcohol use were expected. To conduct one-tailed t -tests with 80% power and $\alpha = 0.05$, 310 participants per group were determined [41], resulting in an intended sample size of 1238 participants, allowing for 25% dropout at the 15-month follow-up. Two-tailed tests required 394 participants per group.

Follow-ups

The 3-month assessment and the 6- and 15-month follow-ups were predominantly computer-assisted telephone interviews [84.6% (3 months), 76.3% (6 months), 72.0% (15 months)]. For the follow-ups, attempts were made to conceal allocation. However, not all the 13 interviewers were blinded. If 10 or more contact attempts failed, participants received an accompanying questionnaire by mail or e-mail, with up to three reminders. For the 15-month follow-up, participants within 50 km driving distance were also contacted at their homes. The 6-month follow-up participants received a voucher of €30; the 15-month follow-up participants took part in a lottery drawing of 20 vouchers at €50.

Interventions

The stage tailored and the non-stage tailored intervention consisted of individualized computer-generated feedback letters and self-help manuals. Both interventions were delivered at two time-points: after baseline and after the 3-month assessment. Non-participants of the 3-month assessment did not receive a second intervention. All letters were created by an expert system software programmed in Microsoft Access 2007, which selected text modules based on assessment data and pre-defined selection rules [42]. Such computer-based interventions are effective, particularly in large population samples [43]. Letters and manuals were sent out by ordinary mail. Table 1 shows similarities and differences between the two interventions.

Stage tailored intervention (ST)

The ST letters were based on the TTM [1,46]. As described elsewhere [47], assessment data of the Readiness to Change Questionnaire (RCQ [46,47][48,49]), of an

eight-item version of the Alcohol Decisional Balance Scale [50,51], of a 10-item version of the Alcohol Abstinence Self Efficacy Scale [52,53] and of a 20-item version of the Processes of Change scale [54,55] were used to provide stage tailored feedback. Each text module was dependent upon current stage of change. The participant's responses were compared to normative data of individuals in the same stage. These normative data were obtained from a previous RCT [56] conducted by our research collaboration, 'Early Intervention in health risk behaviours'. The letters referred to particular pages in the accompanying stage-matched manual for further information, advice and practice. The manuals were based on the manual 'Handling alcohol use: information, tests and support in 5 stages' [57]. To provide stage-matched information only, the original manual was divided into four separate manuals, one for each stage (action and maintenance combined).

Non-stage tailored intervention (NST)

The non-stage tailored intervention (NST) letters were based on the TPB [5]. Assessment data on attitude, subjective norm, perceived behavioural control, according beliefs (behavioural, normative, control) and their evaluations were used to provide feedback as suggested by Ajzen [58]. A total of 40 items and seven-point scales were created according to Francis *et al.* [59] and Ajzen [60]. Feedback was accompanied by information and/or advice. Participants were encouraged to complete a when/where/how-to-change plan, introduced by gender-specific examples. While each text module of the ST always depended upon stage of change, each text module of the NST was independent of any other TPB construct. The letters referred to particular pages of the standard manual: 'All right. Advices and information on responsible alcohol use' [61].

Controls

The controls received minimal assessments. Measures on any of the theoretical constructs (apart from the RCQ) and feedback/manual were not provided.

Measures

Alcohol-related variables

Unhealthy alcohol use was determined using the Alcohol Use Disorder Identification Test—Consumption (AUDIT-C [62]). Women with values ≥ 4 and men with ≥ 5 [63] were included in the trial. Individuals with particularly severe alcohol problems were identified and excluded from further participation using the total AUDIT score [64] and values ≥ 20 [65].

Table 1 Components of the stage and the non-stage tailored intervention.

| | Similarities | Differences | |
|--|---|---|---|
| | Both interventions | Stage tailored intervention | Non-stage tailored intervention |
| Delivery of intervention | | | |
| Method of delivery | Individualized feedback letters (2–3 pages) plus self-help manuals | No difference | No difference |
| Number of interventions | Two (at baseline, 3 months later) | No difference | No difference |
| Content of letters | | | |
| Definition of low-risk drinking ^a | Yes, gender-specific | No difference | No difference |
| Individual feedback on drinking and risk of its adverse consequences | Yes, gender-specific, including normative ^b and ipsative ^c feedback | No difference | No difference |
| Theoretical background | Not similar | Transtheoretical model of change (TTM) | Theory of planned behaviour (TPB) |
| Theoretical constructs | Not similar | All constructs of the TTM ^d | All constructs of the TPB ^e |
| Normative feedback of theoretical constructs ^b | Not similar | Yes, compared to others in the same stage | No |
| Ipsative feedback of theoretical constructs ^c | Yes, compared to oneself at baseline (only letter 2) | Regarding TTM constructs | Regarding TPB constructs |
| When/where/how-to-change plan | Not similar | No | Yes |
| Text modules | Not similar | Depended on stage of change | Independent of other constructs |
| Total number of text modules in pool | Not similar | Letter 1: 128, letter 2: 294 | Letter 1: 75, letter 2: 144 |
| Content of self-help manuals | | | |
| Range of manuals | Not similar | Participants received one of four stage matched manuals | Participants received a standard manual |
| Length of manuals | Not similar | PC 9, C 16, P 20, AC 24 pages | 66 pages |

PC = pre-contemplation; C = contemplation; P = preparation; AC = action. ^aAccording to the German Centre for Addiction Issues [44] and to the National Institute on Alcohol Abuse and Alcoholism [45]. ^bCompared to others. ^cCompared to oneself at baseline (only letter 2). ^dStage of change, decisional balance, cognitive processes (pre-contemplation, contemplation only), behavioural processes (preparation, action only), self-efficacy (contemplation, preparation, action only). ^eAttitude and behavioural beliefs, subjective norm and normative beliefs, perceived behavioural control and control beliefs.

The primary outcome measure was a latent alcohol use factor based on two indicators: the AUDIT-C score (possible range: 0–12) and the total number of drinks in the past week, which was derived from seven items. These asked for the number of alcoholic drinks consumed on each day in the past week prior to the assessment. A drink (10–11 g of pure alcohol) was defined as 0.25 l beer, 0.1 l (sparkling) wine or 4 cl spirits.

The number of alcohol use disorder (AUD) symptoms was assessed using AUDIT items 4–10, asking for symptoms of alcohol dependence and experienced alcohol-related harm. Items were coded 0 if participants had not experienced any symptoms in the past 12 months (or else 1) and summed (possible range: 0–7).

Socio-demographic variables

Socio-demographic variables included gender, age, living in a partnership and school education. For international comparability, German school types were categorized as: <10 years, 10–11 years and >11 years of school.

Unemployment-related variables

Unemployment-related variables included recruitment site and duration of unemployment. The latter was assessed by the number of months currently and altogether unemployed.

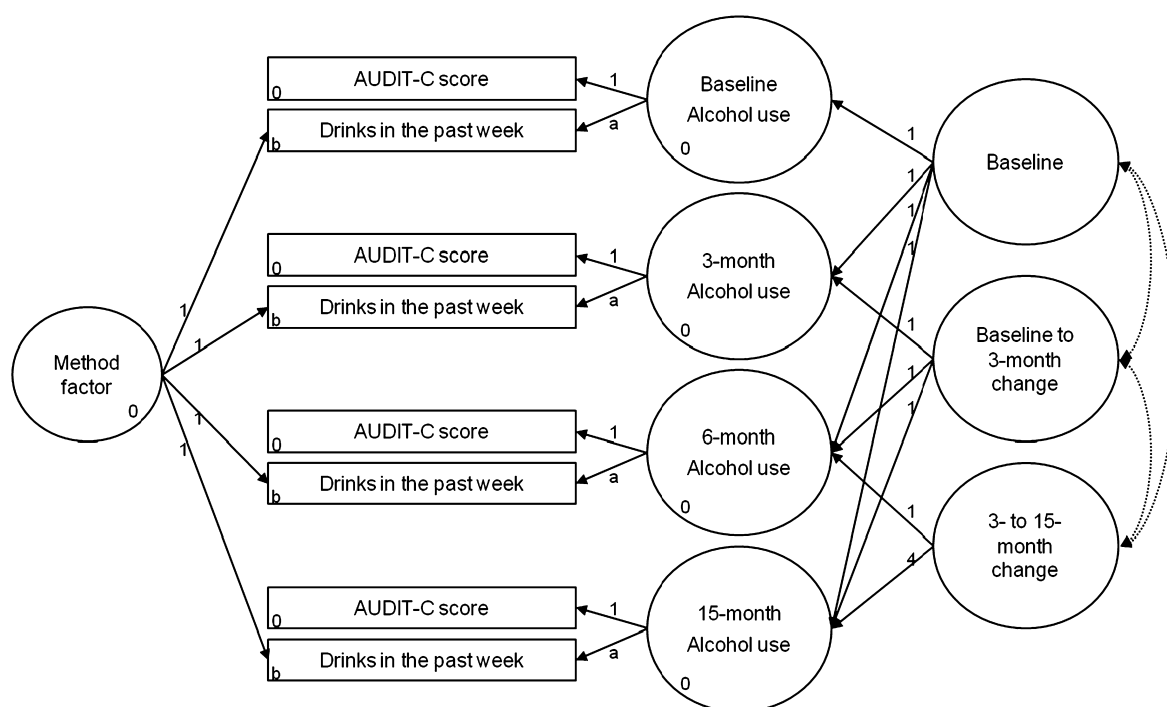


Figure 1 Piecewise latent growth model. AUDIT-C: Alcohol Use Disorder Identification Test-Consumption

Motivation to change

Motivation to change was assessed using the German version [48] of the RCQ [49]. It was developed to allocate non-treatment-seeking individuals with unhealthy alcohol use to the stages of change according to the TTM [1]. The measure focuses on reducing alcohol use rather than abstaining from it. It has been shown to be reliable [49] and to predict drinking outcome [66,67]. The 12-item RCQ consists of three subscales [pre-contemplation (pc), contemplation (c), action (ac)], with four items each and a five-point Likert scale [strongly disagree (-2)/strongly agree (+2)]. Two methods of stage allocation were applied consecutively. The quick method allocates individuals to three stages of behaviour change [pre-contemplation (PC), contemplation (C), action (AC)] based on the highest scale scores; in case of ties, individuals are allocated to the higher stage [67]. The refined method allocates individuals to preparation (P) as well, analysing score profiles (PC if $pc > 0 + c \leq 0 + ac \leq 0$; C if $pc \leq 0 + c > 0 + ac \leq 0$; P if $pc \leq 0 + c > 0 + ac > 0 + c > ac$; AC if $pc \leq 0 + c > 0 + ac > 0 + c \leq ac$) [67]. It does not allocate all individuals to a specific stage, but results in a slightly better prediction of subsequent drinking than the quick method [67]. In our study, to allocate all individuals to all four stages, the refined method was used first. Individuals not allocated were then allocated to PC, C or AC using the quick method.

Statistical analyses

To investigate separately intervention effects on alcohol use after the first intervention (active intervention phase, months 0–3) and after the second intervention (post-intervention phase, months 3–15, primary outcome), piecewise latent growth models (LGMs) were calculated using Mplus version 6.12 [68]. A maximum likelihood estimator with robust standard errors was applied using all available data under a missing at random assumption (MAR [69]). To allow for chance imbalances and to make the MAR assumption more plausible, baseline variables (sex, age, school education, duration of total unemployment, recruitment site, motivation, number of AUD symptoms) were included as covariates.

In the piecewise LGMs, a latent alcohol use factor at each of the four assessment points was estimated using two indicators [70]: the AUDIT-C score and the total number of drinks in the past week (log-transformed). Based on these factors, three latent change factors were specified: baseline alcohol use, change from baseline to 3-month assessment and change from 3- to 15-month assessment. Factor loadings and intercepts belonging to the same indicator were fixed to be equal over time to ensure measurement invariance [71], and the means of the four latent alcohol use factors were fixed to 0 (Fig. 1). A method factor was included to separate indicator-specific method effects that generalize over time [72].

A two-step procedure was applied: change factors were regressed on study group (controls versus ST, NST versus ST) and motivation (four-point continuous measure) at the first step; and on study group, motivation and study group \times motivation interaction terms at the second step.

Using Stata version 12 [73], dropout analyses involved multivariable logistic regressions with all socio-demographic and unemployment-related variables as predictors, and listwise exclusion of missing values.

RESULTS

Sample

Of the job-seekers eligible for trial inclusion, 1243 (72.4%) gave informed consent and received their allocated intervention (Fig. 2). Sample characteristics are displayed in Table 2. Non-participants were older; they were more often male, had <10 years of school and were from site 1 (P s < 0.01). Three-month assessment data were provided by 1054 participants (84.8%), and 85.0%/81.5% of the ST/NST group received their second intervention. Six- and 15-month follow-up data were provided by 1049 (84.4%) and 905 (72.8%) participants, respectively. At all three follow-ups, non-participants more often had <10 years of school than participants (P s < 0.05), and differed regarding recruitment site (P s < 0.05). To test the MAR assumption, dropout at all three follow-ups was regressed on both outcome variables (AUDIT-C, drinks in past week) and their interactions with school and site. Neither of the two outcome variables nor the interactions were significant predictors of dropout.

Changes in alcohol use over time

As shown in Table 3 and Fig. 3, study groups were equivalent on initial levels of alcohol use, baseline to 3-month change and 3–15-month change. All groups reduced alcohol use during the active intervention phase from baseline to month 3 (controls: mean = -0.866 ; NST: mean = -0.883 ; ST: mean = -0.718 , P s ≤ 0.001).

Motivation as moderator of intervention efficacy

When including study group \times motivation interactions, all study groups reduced alcohol use from baseline to month 3. Post-intervention, only the ST group further reduced alcohol use, with a greater reduction than the controls ($\beta = 0.135$, $P = 0.039$, Cohen's $d = 0.42$) and the NST group ($\beta = 0.180$, $P = 0.009$, $d = 0.55$). At the 15-month follow-up, the ST group showed a lower level of alcohol use than the controls (mean difference = -0.633 , $P = 0.018$) and the NST group (mean difference = -0.480 , $P = 0.077$).

Significant study group \times motivation interactions indicated that the effect of the intervention on 3–15-month changes depended on the level of initial motivation: the higher the motivation, the better the outcomes for the NST group compared to the ST group ($\beta = -0.118$, $P = 0.010$).

DISCUSSION

The aim of this study was to provide a fair comparison of the efficacy of a stage versus a non-stage tailored intervention. In contrast to results from systematic reviews [12,13,28,29], the RCT conducted among job-seekers with unhealthy alcohol use and little overall motivation to change revealed a more profound decrease of alcohol use in response to the stage tailored intervention in individuals with low motivation to change, and with regard to post-intervention outcomes at 15 months.

In line with previous findings [22,23], initial motivation moderated the intervention efficacy: the lower the motivation, the more the individuals benefited from stage tailoring. However, the non-stage tailored intervention produced better results in individuals with at least some motivation to change; it was the better later stage intervention (although not better than no intervention: $\beta = 0.050$, $P = 0.196$). A possible explanation might be that the non-stage tailored intervention contained the when/where/how-to-change plan [75]. So-called implementation intentions have quite a large effect on future behaviour [76] and the potential to reduce the intention-behaviour gap [77]. Higher-motivated individuals may require more of such self-regulative strategies than provided by our stage tailored intervention. Thus, the superiority of our non-stage tailored intervention among individuals with at least some motivation to change could otherwise be interpreted as supporting stage models. Being an action-orientated strategy, the when/where/how-to-change plan would be perfectly suitable for individuals in higher stages according to the TTM.

In agreement with findings from a stage tailored smoking cessation intervention [19], the effect of our stage tailored alcohol intervention increased over time. While all three groups reduced alcohol use after the first intervention, only the ST group kept reducing in the long term, after the second intervention. This is in line with the TTM, as pre-contemplators who constituted this sample's majority are expected to require more time to change than individuals in advanced stages. They need to pass through various stages, not yet visible on the behavioural level. Descriptive data (not reported) show that after the first intervention, 16.5% of the controls, 21.5% of the NST group and 23.3% of the ST group had progressed to a higher stage (or remained in action). Stage progression as a mediator of intervention efficacy should be

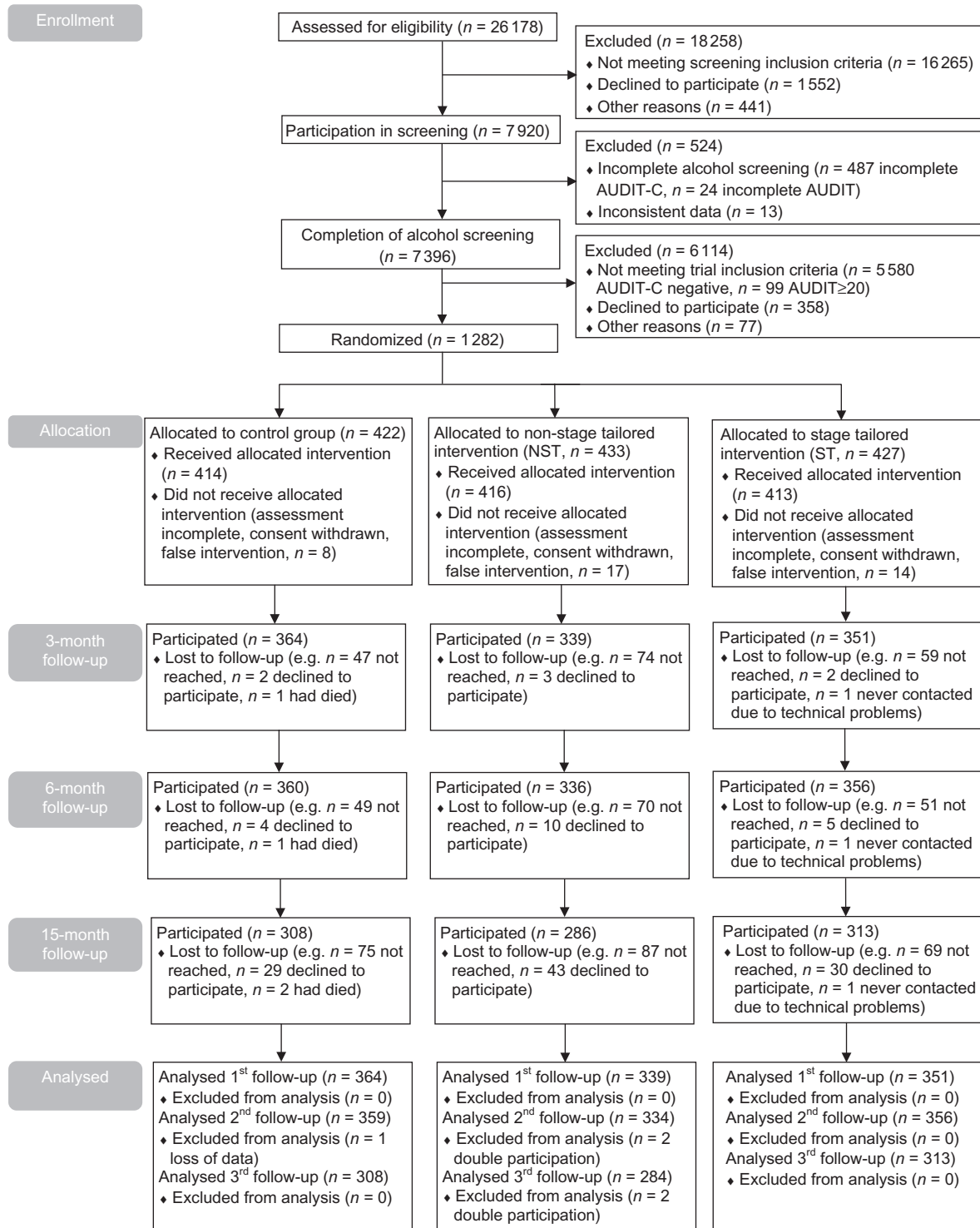


Figure 2 Participant flow chart according to Consolidated Standards of Reporting Trials (CONSORT) 2010 statement [74]. Primary outcome analyses included all participants with responses on baseline variables (controls, $n = 414$; non-stage tailored intervention (NST), $n = 416$; stage tailored intervention (ST), $n = 413$)

investigated in the future. Furthermore, longer-term follow-ups beyond month 15 are needed, as intervention effects may further increase [19].

Further limitations should be noted. First, we relied upon self-report of alcohol use. However, neither bio-

chemical markers nor collateral information increase correctness of alcohol consumption in clinical trials [78]. Secondly, the skewness of the motivation measure may have affected our results, and a sample composition with an equal distribution of the initial stages would have been

Table 2 Sample characteristics stratified by study group.

| Variables | Controls | Non-stage tailored | Stage tailored |
|---|------------|--------------------|----------------|
| <i>n</i> | 414 | 416 | 413 |
| Alcohol-related variables | | | |
| Number of drinks past week (M, SD) | 12.7, 12.8 | 12.9, 14.0 | 12.6, 12.9 |
| AUDIT score (M, SD) | 8.0, 3.8 | 8.4, 3.8 | 7.6, 3.3 |
| AUDIT-C score (M, SD) | 5.7, 1.5 | 5.8, 1.5 | 5.6, 1.4 |
| Number of AUD symptoms (M, SD) | 1.1, 1.4 | 1.2, 1.3 | 1.0, 1.2 |
| Socio-demographic variables | | | |
| Male (<i>n</i> , %) | 265, 64.0 | 262, 63.0 | 266, 64.4 |
| Age in years (M, SD) | 30.1, 10.9 | 30.6, 11.7 | 29.5, 10.7 |
| Living in a partnership (<i>n</i> , %) | 233, 56.3 | 233 56.0 | 241 58.4 |
| School education (<i>n</i> , %) | | | |
| <10 years | 83, 20.0 | 86, 20.7 | 91, 22.0 |
| 10–11 years | 242, 58.5 | 217, 52.1 | 209, 50.6 |
| >11 years ^a | 89, 21.5 | 113, 27.2 | 113, 27.4 |
| Unemployment-related variables | | | |
| Recruitment site (<i>n</i> , %) | | | |
| Site 1 | 131, 31.6 | 141, 33.9 | 156, 37.8 |
| Site 2 | 128, 30.9 | 115, 27.6 | 97, 23.5 |
| Site 3 | 155, 37.4 | 160, 38.5 | 160, 38.7 |
| Current unemployment in months (M,SD) | 5.0, 16.9 | 4.5, 16.2 | 3.9, 10.8 |
| Total unemployment in months (M, SD) | 25.6, 41.7 | 24.3, 36.3 | 20.0, 32.3 |
| Motivation to change (<i>n</i> , %) | | | |
| Pre-contemplation | 308, 74.4 | 318, 76.4 | 321, 77.7 |
| Contemplation | 47, 11.4 | 44, 10.6 | 41, 9.9 |
| Preparation | 8, 1.9 | 12, 2.9 | 7, 1.7 |
| Action | 51, 12.3 | 42, 10.1 | 44, 10.7 |

AUD = alcohol use disorder; AUDIT = Alcohol Use Disorder Identification Test; *n* = number of cases; M = mean; SD = standard deviation. ^aIncluding those still in school.

optimal. None the less, the predominance of individuals initially not thinking about change represents population characteristics more clearly in most non-clinical settings (e.g. [48]). Implications with regard to higher-motivated individuals should be derived cautiously. Thirdly, the intervention effects ranged between small and medium. However, it appears clinically significant that behavioural effects were achieved in individuals initially not thinking about change. To approximate what our findings relate to, data (not reported) revealed that, among the initial pre-contemplators of the 15-month follow-up participants, the ST group exceeded the controls' and NST group's reductions of alcohol use in the past week by approximately one and two standard drinks, respectively. Considering the predominance of individuals with low initial motivation to change in our typically 'hard-to-reach' target population, our proactive stage tailored intervention approach may have achieved a high impact on the population level, as proposed by Prochaska & Velicer [1]. Fourthly, although our study could be widely applicable considering the automated character of our interventions, the application of our findings to other behaviours, (non-proactively recruited) populations and

settings, and to similar settings in other countries should be investigated.

Stage tailored alcohol interventions may, in the long term, result in more favourable outcomes than no intervention and non-stage tailored interventions of the same intensity, given that initial motivation to change is rather low. This may be particularly valuable when thinking in terms of population impact. Our findings support that individuals with low motivation to change alcohol use require different interventions from those with at least some motivation.

Clinical trial registration

ClinicalTrials.gov NCT01311245.

Declaration of interests

None.

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Table 3 Coefficient estimates and effect sizes resulting from the piecewise latent growth models.

| Step | | Baseline | | | Baseline to 3-month change | | | 3–15-month change | | |
|------|------------------------------|--------------|--------|--------|----------------------------|--------------|--------|-------------------|--------------|--------|
| | | β | 95% CI | P | B | 95% CI | P | β | 95% CI | P |
| 1 | Intercept (ST trajectory) | 6.245 | 5.943 | 6.547 | <0.001 | -0.718 | 0.077 | 0.001 | -0.093 | 0.112 |
| | Controls | | | | | | | | | |
| | NST | 0.057 | -1.148 | -0.288 | 0.480 | -0.148 | 0.077 | 0.198 | -0.031 | 0.112 |
| | Motivation | 0.112 | -0.224 | 0.037 | 0.160 | -0.164 | 0.063 | 0.157 | -0.064 | 0.086 |
| | Effect | -0.017 | -0.089 | 0.056 | 0.655 | 0.013 | 0.126 | 0.827 | -0.029 | 0.007 |
| 2 | ST versus controls | $d = 0.065$ | | | | $d = -0.131$ | | | $d = 0.121$ | |
| | ST versus NST | $d = 0.128$ | | | | $d = -0.145$ | | | $d = 0.033$ | |
| | NST versus controls | $d = 0.063$ | | | | $d = -0.014$ | | | $d = -0.088$ | |
| | Intercept (ST trajectory) | 6.255 | 5.929 | 6.581 | <0.001 | -0.728 | -0.272 | 0.002 | -0.185 | -0.031 |
| | Controls | 0.117 | -0.162 | 0.396 | 0.411 | -0.023 | 0.390 | 0.914 | 0.135 | 0.262 |
| | NST | 0.028 | -0.251 | 0.307 | 0.845 | -0.267 | 0.156 | 0.216 | 0.180 | 0.315 |
| | Motivation | -0.021 | -0.137 | 0.096 | 0.730 | 0.024 | -0.129 | 0.758 | -0.034 | 0.095 |
| | Controls \times motivation | -0.039 | -0.205 | 0.126 | 0.642 | -0.082 | -0.331 | 0.166 | -0.066 | 0.013 |
| | NST \times motivation | 0.058 | -0.114 | 0.229 | 0.510 | 0.070 | -0.194 | 0.602 | -0.118 | -0.028 |
| | Effect | $d = 0.135$ | | | | $d = -0.020$ | | | $d = 0.415$ | |
| | ST versus controls | $d = 0.032$ | | | | $d = -0.236$ | | | $d = 0.553$ | |
| | NST versus controls | $d = -0.102$ | | | | $d = -0.215$ | | | $d = 0.138$ | |

NST = non-stage tailored group; ST = stage tailored group; β = unstandardized regression coefficient; CI = confidence interval; d = Cohen's d ; $d \geq 0.2$ small effect; $d \geq 0.5$ medium effect. Fit for both models: Comparative Fit Index = 0.94; root mean square error of approximation = 0.05, 90% CI = 0.04–0.05. Models included sex (0 = men), age, school education (0 = 10–11 years), total unemployment, number of AUD symptoms and recruitment site (0 = site 1) as covariates and living in a partnership as an auxiliary variable.

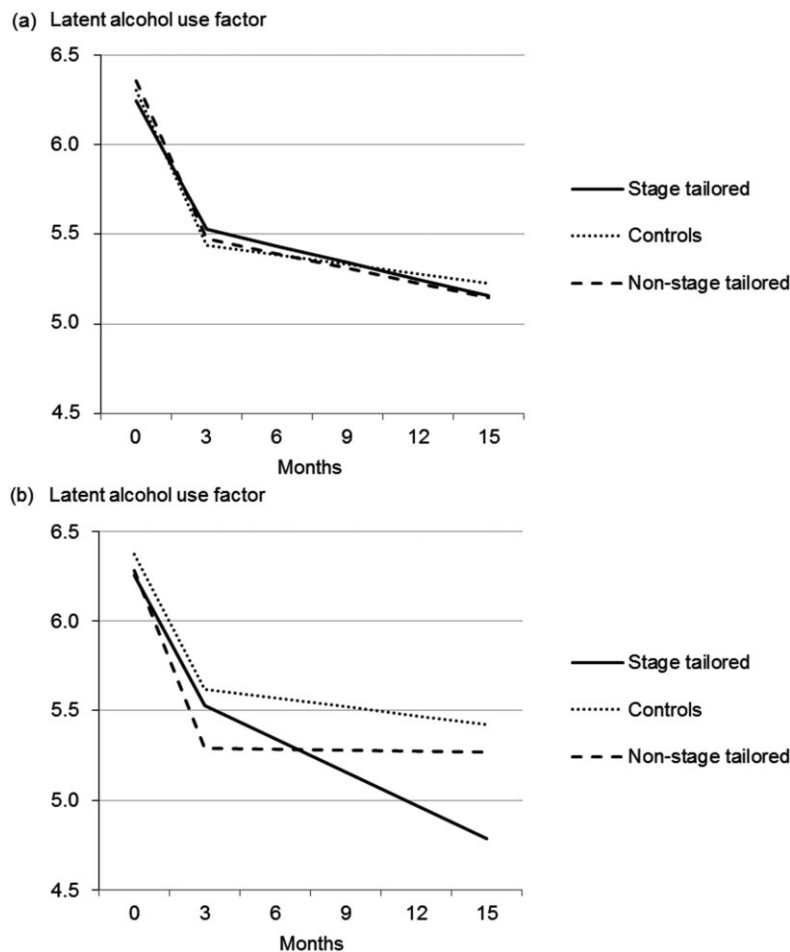


Figure 3 Modelled courses of latent alcohol use in the piecewise latent growth model with (a) and without (b) study group by motivation interactions

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