

Motivational Interviewing Technical and Relational Skills, Change Talk, and Alcohol Outcomes – A Moderated Mediation Analysis

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Abstract

Objective: Change talk has been proposed as a mechanism of change in motivational interviewing (MI) by mediating the link between MI technical skills and behavioral outcomes. We tested the influence of therapists' relational skills on this mediation model.

Method: Secondary analysis of a randomized controlled trial of individual brief MI for heavy drinking among 20-year old Swiss young men, where the MI group ($n = 179$) significantly reduced drinking compared to an assessment-only control. We coded MI sessions and derived: therapists' MI technical skills, clients' change talk (CT) and sustain talk (ST), and global relational ratings (empathy and MI spirit). We tested moderated mediation models with technical skills as the independent variable, CT and ST as parallel mediators, predicting drinking at 3-month follow-up (controlling for baseline drinking), and relational skills as moderators of the path from technical skills to client mediators. **Results:** Conditional indirect effects were significant for overall MI technical skills, open questions and simple reflections (i.e., more of these behaviors related to *more* ST, which was related to *more* drinking) when relational skills were *low*. In contrast, there was a significant conditional indirect effect for complex reflections when relational skills were *high* (i.e., more complex reflections related to *less* ST). **Conclusions:** This study provides partial support for the MI technical and relational process models. Interestingly, support was found regarding the negative side of client ambivalence (ST) in this highly pre-contemplative sample. Accordingly, MI therapists should work cautiously with ST when clients are at early stages of motivational readiness.

Keywords

Motivational interviewing; Moderated mediation analyses; Change talk; Technical and relational skills; Alcohol treatment for young adults.

Public Health Significance Statements

This study suggests that both motivational interviewing techniques and relational skills influence clients' discussion about change, and subsequent changes in alcohol use. Contrary to expectations, some motivational interviewing techniques were associated with discussion about *not changing*, which predicted more drinking three months later. This was the case only when therapist relational skills were below competence thresholds. Therapists using motivational interviewing should be attentive to clients' speech about *not changing* (sustain talk) and a combination of relational skills such as empathy and the use of complex reflections might be particularly important when clients are at early stages of motivational readiness.

Motivational Interviewing (MI) has been found to be an efficacious intervention for substance use behaviors in several meta-analyses (DiClemente et al., 2017; Lundahl & Burke, 2009). Nevertheless, the strength of the effects tend to be small to moderate and variable across substances, study populations, or treatment content and format. In order to enhance MI effectiveness, a growing number of studies have investigated MI processes as a way to inform MI providers and trainers about best practices in this psycholinguistic therapeutic approach. MI process studies often rely on the seminal article by Miller and Rose (2009), which outlined a theorized explanatory model of how MI skills influence client motivation and decision-making in relation to behavior change outcomes. Two primary predictive components were described: 1) a relational component focused on empathy and the interpersonal spirit of MI, and 2) a technical component involving the evocation and reinforcement of *client change talk* (i.e., client language expressed in favor of a specified behavior change).

The majority of MI process research has focused on the technical hypothesis where therapists' technical skills (e.g., open questions, simple and complex reflections) are expected to increase clients' change talk, which is expected to subsequently predict changes in behavior. In a recent meta-analysis of MI process studies, Magill and colleagues (2018) identified 58 reports (N = 3025 participants) and showed that therapist MI technical skills were significantly correlated with more client change talk. Client change talk was not significantly correlated with outcome, but *sustain talk* (i.e., all client language expressed against behavior change or in favor of the status quo) was associated with worse outcome. When technical process indicators were combined into proportion variables, the overall hypothesis was supported in that proportion of MI skills that were consistent with the MI

approach was related to a higher proportion of client statements in favor of behavior change and a higher proportion of change talk was related to reductions in risk behavior at follow up.

The relational hypothesis has also been investigated, but has received comparatively less attention in the MI literature. In early studies, empathy and interpersonal skills were strongly related to better drinking outcomes (i.e., relapse rate and drinking measures), among clients with alcohol use disorder (Miller & Baca, 1983; Valle, 1981). Results have been more mixed in recent studies. In meta-analysis, ratings of therapist relational skills (i.e., empathy, MI spirit) did not significantly predict client behavior change at follow-up (Magill et al., 2018). Similarly, Pace et al. (2017) found no direct relationship between therapist relational skills and client outcomes across 11 studies of MI process. While no direct effects for therapist relational skills have been observed in these studies, meta-analyses have also considered conditional, or moderated effects. In other words, studies have considered whether the technical model of MI process is valid only when the ratings for the therapists' relational skills are high. Here, Magill et al. (2018) examined a conditional process model where variability in MI technical process was moderated by the relational proficiency of therapists (i.e., "low" or "high" ratings). The study found this relational factor explained some effect size variance, but the sub-group effect sizes remained small and similar in magnitude regardless of whether relational proficiency was rated as low versus high.

The noted studies have tested individual correlation pathways, which has its inherent limitations. However, some studies have gone a step further and combined paths using more complex statistical analyses such as mediation analyses, structural equation modeling, or moderated mediation analyses. Four studies have supported the full technical hypothesis in single mediation models (Barnett et al., 2014; Houck et al., 2018; Moyers et al., 2009; Pirlott et al., 2012). In a previous analysis of the current study sample (Gaume et al., 2016), we showed that change talk mediated the relationship between MI technical skills and drinking

outcomes, but only when therapists had more experience in MI and when clients had more severe alcohol use patterns (i.e., significant conditional indirect effects). A recent study tested the moderating effect of relational skills on the growth of client change talk, relative to sustain talk, but found no significant moderated mediation effects (Magill et al., 2019). Finally, studies have tested the influence of relational skills on MI process, rather than outcome. For example, a recent study showed that relational skills predicted reflections of change talk and sustain talk, which in turn predicted client change talk (Villarosa-Hurlocker et al., 2019). The authors concluded that the synergistic implementation of the relational and technical components of MI is critical to facilitating a higher percentage of change talk during MI sessions.

In the present study, we aimed to test the influence of therapists' relational skills on the technical mediation model. Specifically, we first tested a mediation model with client change and sustain talk as parallel mediators of the effect of therapist MI technical skills on client drinking at 3-month follow-up, while controlling for baseline drinking. We then added empathy and MI spirit as moderators of the effects of MI technical skills on mediators (*a* paths). According to MI theory (Miller & Rollnick, 2013; Miller & Rose, 2009), we expected MI technical skills to be related to higher change talk, which in turn should relate to reductions in drinking. Furthermore, we postulated that these relationships would be stronger when relational ratings were high. Regarding sustain talk, and given MI is designed to explore and resolve ambivalence, MI technical skills were also expected to result in some increase in sustain talk, but to a lesser extent. In addition to the frequency of therapists' overall MI technical skills, we also tested moderated mediation models for the most frequent MI technical skills (i.e., open questions, simple reflections, and complex reflections). For these ancillary analyses, we had similar hypotheses, but we expected stronger effects for

complex reflections, which go beyond what is said and can offer a new perspective and may shift a person's understanding or feeling about the situation.

Method

Sample and parent study procedures

Study participants were from a randomized controlled trial of BMI among hazardous drinkers included within the Army Recruitment Center of Lausanne, Switzerland (Gaume et al., 2014). Briefly, 1023 conscripts were randomly selected and offered participation in the study, while attending the two-day army conscription process (i.e., mandatory for all males at age 19). This frame thus offered a representative sample of all French-speaking Swiss young men. Of those, 192 were not included due to priority army assessment, 194 refused participation, and 196 were excluded as they reported non-hazardous alcohol use, based on a score lower than 4 on the Alcohol Use Disorders Identification Test (AUDIT)–Consumption (Bush et al., 1998). Of the remaining participants, 217 were randomly allocated to the BMI condition and 224 to a control condition with no intervention. Intervention was a non-manualized, 20 to 30-minute BMI, exploring alcohol use, its related consequences, and upon participant agreement, a change plan discussion. Therapists were nine physicians and nine psychologists, selected to provide varied backgrounds, gender parity, and a range of clinical and MI experience for the parent trial (Gaume et al., 2014). Study procedures were approved by the Ethics Committee for Clinical Research of the Medical School of the University of Lausanne (Protocol 15/07) and registered on www.isrctn.com/ISRCTN92486583.

Within the BMI condition, 208 interventions (95.9%) were completely audio-recorded while the remaining nine had technical problems. At 3-month follow-up, 174 (83.7%) of those participants were reached. Previous descriptive analyses of this sub-sample (Gaume et al., 2016) showed that these young men drank a bit more than two days per week and about

five drinks per drinking day. About one third had binge drinking episodes (i.e., six drinks or more in one episode) weekly, one third monthly, and one third less than monthly. Severity of alcohol use patterns (based on the AUDIT) was in the mid-range on average, between hazardous drinking (score of 8, Babor et al., 2001) and probable dependence (score of 12, Gache et al., 2005). Readiness to change was low, the University of Rhode Island Change Assessment Scale - Reduced Drinking Version (Soderstrom et al., 2007) indicated these young men were mostly at the pre-contemplation level.

Observational coding methods

BMI sessions were coded using the Motivational Interviewing Skill Code (MISC), version 2.1 (Miller et al., 2008). Four master-level students were trained in using the MISC (about 60 total hours of training) and then independently parsed and coded interventions while blinded to assessment and follow-up data. One additional person did only parsing. Discrepancies and challenges were addressed weekly in joint trainer-coder meetings throughout the entire data collection period. Coding procedure involved two passes through each session. The first, uninterrupted pass assessed global ratings, intended to capture the rater's overall impression of therapist's acceptance (not used in the present report), empathy, and MI spirit (a composite of collaboration, evocation of change, and support of patient's autonomy), each assessed on a 7-point Likert scale. During the second pass, the coder categorized each therapist or client statement using one of the 19 therapist and eight client codes. Therapist technical skills considered MI-consistent are as follows: advise with permission, affirm, emphasize control, open questions, simple and complex reflections, reframe, and support. We also analyzed open questions, simple reflections and complex reflections, given these are the most commonly utilized in MI. Regarding young men's speech, we used two summary scores: frequency of change talk utterances (ability to change,

commitment to change, desire to change, need to change, reasons to change, and taking Steps toward change) and frequency of sustain talk utterances (inability to change, commitment not to change, desire not to change, lack of need for change or a need not to change, reasons not to change, and taking steps away from change). A random subsample of 42 BMI sessions (20.19%) was double-coded to assess inter-rater reliability. Intra-class correlations (ICCs) indicated that agreement was *good* to *excellent* (Cicchetti, 1994) for all individual codes (ICCs ranging from .66 to .99) and *excellent* for codes retained in the present analyses (MI technical skills: .99, open questions: .96, simple reflections: .97, complex reflections: .88, change talk: .81, sustain talk: .99, empathy: .74, MI spirit: .78).

Outcome measure

Measures were the same for the 3-month follow-up as at baseline except that they were framed within a 3-month window instead of 12-month. The outcome measure was the primary outcome from the parent study (Gaume et al., 2014), which was a drinking composite score computed from the mean of the z scores for a) usual drinking days per week, b) usual drinks per drinking day, and c) frequency of binge drinking (third question of the AUDIT used as continuous scale from 0 to 4). In order to illustrate the size of the measured effects (which are not straightforward using z scores), we used the measure of weekly drinking amount, which is the combination of a) usual drinking days per week and b) usual drinks per drinking day, which was highly correlated with our composite score, $r(172) = .87$, $p < 0.0001$.

Statistical analysis

We used mediation and moderated mediation analyses to test our hypotheses. Mediation analyses posit how, or by what means, an independent variable (X, here frequency of

therapist's MI technical skills) affects a dependent variable (Y, here the drinking composite score at 3-month follow-up) through one or more potential intervening variables, or mediators (M, here frequency of young men's change talk and sustain talk). The indirect effect of X on Y through M can then be quantified using bootstrapping, a nonparametric resampling procedure that does not impose the assumption of normality of the sampling distribution (Hayes, 2013; Preacher & Hayes, 2008). We used this approach with 5000 bootstraps as implemented in Model 4 of the PROCESS macro for SPSS (Hayes, 2013), with change talk and sustain talk treated as parallel mediators. All models were adjusted for the drinking composite score at baseline.

Moderated mediation tests whether a mediation effect remains constant across different modifying factors (i.e., measuring indirect effects at different values of a moderating variable, W, here empathy and MI spirit ratings, see Figure 1). We used Model 8 of the PROCESS macro for SPSS (Hayes, 2013), which specifies that the moderator influences the *a* path ($X \rightarrow M$) and *c'* path ($X \rightarrow Y$, controlling for M) of the mediated relationship. Indirect effects were estimated at three levels of the moderator variable: 1) moderator mean, 2) mean plus one standard deviation, and 3) mean minus one standard deviation. Moderated mediation models were built separately for empathy and MI spirit and controlled for the baseline drinking composite score.

Effect sizes in mediation analyses have been largely debated (Hayes, 2013; Preacher & Kelley, 2011; Wen & Fan, 2015) and effect sizes for moderated mediation and parallel mediation with covariates have not been proposed to our knowledge. Despite its limitations, we used the *ratio of the indirect effect to the total effect* as a measure of effect size, but only when total effects were larger than indirect effects and of the same sign, as recommended by Hayes (2013) and used in other articles using similar methods (see e.g., Probst et al., 2016). In addition, we present the size of association using the linear prediction for an increase of

one standard deviation of the independent variable (e.g., the difference on Y between the mean of X and the mean of X + 1SD).

The main analysis used summed counts of MI technical skills, and change and sustain talk. In order to account for the total number of utterances within a session, we repeated analysis using percentages (i.e., as sensitivity analysis). To do so, we divided the specific therapist behavior by all therapist behaviors (e.g., total open questions/total therapist behaviors*100) and the specific client language measure by all client language measures (e.g. total change talk statements/total client statements*100).

Finally, our models assume a temporal association between MI technical skills and client change and sustain talk, because the goal of the MI therapist is to facilitate an exploration of behavior change. However, regression analyses at the session level do not allow testing these assumed relationships. In further sensitivity analysis, we conducted sequential analyses using Generalized Sequential Quierier (GSEQ, version 5.1.23) software, as proposed in Moyers et al. (2009). Transition probabilities between therapist statements and subsequent patient language were calculated at lag 1 (i.e., the probability that client utterance B will occur immediately following therapist utterance A). We tested whether MI technical skills, open questions, simple reflections, and complex reflections were more likely than expected by chance to be immediately followed by change talk, sustain talk, or neutral statements (i.e., similar to the *a* path in our mediation model) using odds ratios (Bakeman & Quera, 2011). To do so, GSEQ computes contingency tables (i.e., initial event present/not present by subsequent event present/not present). We ran two analyses, one testing MI technical skills (vs. all other therapist's behaviors), and a second testing open questions, simple reflections, complex reflections, and all other therapist's behaviors. In a second step, we tested whether transition likelihood was affected by empathy and MI spirit (i.e., similar to the interaction tested on the *a* path in our moderated mediation model). Since transition analyses at the

session level resulted in too many cells with less than five observations (e.g. less than five transitions from simple reflections to change talk), we pooled sessions with high (score 5–7) vs low (score 1–4) levels of empathy and MI spirit.

Insert Figure 1 here

Results

There was a mean of 48.9 MI technical skills per session ($SD = 24.8$). The most frequent MI technical skills were simple reflections ($M = 31.4$, $SD = 17.5$), open questions ($M = 12.4$, $SD = 6.9$), and complex reflections ($M = 3.8$, $SD = 3.9$). Young men expressed more sustain talk ($M = 11.7$, $SD = 8.3$) than change talk ($M = 7.0$, $SD = 7.8$; $t(173) = -5.9$, $p < 0.0001$). Empathy and MI spirit were rated as rather high on average ($M = 5.0$ and 4.9 , $SD = 1.3$ and 1.1 , respectively).

Analyses of *a* and *b* paths of the mediation models (Table 1) showed a consistent pattern of findings: MI technical skills were strongly and significantly related to higher frequency of change talk, but change talk was not related to drinking behavior at follow-up. However, sustain talk was significantly related to poorer outcomes. MI technical skills and complex reflections were not significantly related to sustain talk, but there was a trend for open questions and simple reflections to be related to higher frequency of sustain talk ($p = .06$ and $.08$, respectively). There were significant indirect effects for open questions and simple reflections, through sustain talk as a mediator. Open questions and simple reflections were related to higher frequency of sustain talk, which was related to more drinking at three months. To illustrate the size of these effects, for an increase of one SD (i.e., 6.9 open questions) there was an increase of 1.2 utterances of sustain talk. On the *b* path, for an increase of one SD (i.e., 8.3 utterances of sustain talk) there was an increase 0.2 points on the

composite score, or 2.1 drinks per week. For simple reflections, there was an increase of 1.2 utterances of sustain talk 1.1 for an increase of one SD (i.e., 17.5); the *b* path was similar. The ratio of the indirect effect to the total effect indicated that respectively 29% and 35% of the positive association between open questions, respectively simple reflections, and alcohol outcomes occurred through increased sustain talk.

Insert Table 1 here

Patterns of findings were similar in analyses with percentages of behaviors over the session instead of the sum of counts (see Supplemental online table 1). The only difference was that the percentage of MI technical skills, of open questions, and of simple reflections were significantly related to higher percentage of sustain talk ($p = .02, .01, \text{ and } .001$, respectively). Consistently, there were significant indirect effects of these behaviors on poorer drinking outcomes through higher percentage of sustain talk.

Moderated mediation analyses showed a similar pattern of findings for empathy and MI spirit. For parsimony, we present only results for the empathy models (Table 2; data for MI spirit are provided in Supplemental online table 2). Findings indicated that there were significant conditional indirect effects for MI technical skills, open questions, and simple reflections when relational skills were *low* (i.e., mean – one SD). Analyses of the interactions on the *a* paths showed significant interactions between relational skills and MI technical skills, open questions, and simple reflections behaviors indicating that the lower the relational skills were, the more MI technical skills, open questions, and simple reflections were related to sustain talk (MI technical skills X Empathy: $B = -0.07, SE = 0.02, p = .002$; Open questions X Empathy: $B = -0.21, SE = 0.08, p = .009$; Simple reflections X Empathy: $B = -0.09, SE = 0.03, p = .003$). To illustrate these effects, when empathy was low (mean – one

SD), an increase of one SD in MI technical skills (i.e., 24.8) was related to an increase of 3.0 utterances of sustain talk, an increase of one SD in open questions (i.e., 6.9) was related to an increase of 3.5 utterances of sustain talk, and an increase of one SD in simple reflections (i.e., 17.5) was related to an increase of 3.2 utterances of sustain talk (see Figure 2).

Insert Table 2 and Figure 2 here

Conditional indirect effects for MI technical skills, open questions, and simple reflections when relational skills were *medium* were in the same direction but estimates were smaller, and only significant for two models: open questions through sustain talk moderated by empathy, and simple reflections through sustain talk moderated by empathy. Here, an increase of one SD in open questions was related to an increase of 1.6 utterances of sustain talk, and an increase of one SD in simple reflections was related to an increase of 2.1 utterances of sustain talk.

In contrast, there was a significant conditional indirect effect for complex reflections when relational skills were *high* (i.e., mean + one SD). Under this circumstance, more complex reflections were related to *less* sustain talk (an increase of one SD, i.e., 3.9 complex reflections, was related to a decrease of 2.1 utterances of sustain talk). As sustain talk was related to poorer drinking outcomes (an increase of one SD in sustain talk was related to an increase of 0.16 points on the composite score and 2.3 drinks per week), this indirect effect was negative, indicating a beneficial effect through less sustain talk. The ratio of the indirect effect to the total effect showed that 68% of the beneficial effect of complex reflections on outcomes was transmitted through decreased sustain talk when empathy was high. These effects were in the same direction, but estimates were smaller when relational skills were

medium (an increase of one SD in complex reflections was related to a decrease of 1.2 utterances of sustain talk).

Conditional indirect effects involving change talk as a mediator were all non-significant. The pattern of findings was consistent when analyses were repeated with percentages of behaviors over the session (see Supplemental online table 3).

Sequential analyses supported the above-mentioned correlational findings. There were 12'528 transitions from therapists' behaviors to client language. MI technical skills were significantly more likely than expected by chance to be followed by change talk ($OR = 2.97$, 95% CI [2.47, 3.58]) and by sustain talk ($OR = 2.65$ [2.27, 3.08]). When looking at open questions, simple reflections, and complex reflections, these three skills were significantly more likely than expected by chance to be followed by change talk ($OR = 1.23$ [1.02, 1.49], 1.87 [1.61, 2.17], and 2.11 [1.62, 2.76], respectively), but only open questions and simple reflections were significantly more likely than expected by chance to be followed by sustain talk ($OR = 1.54$ [1.32, 1.79], 1.86 [1.63, 2.11], and 0.95 [0.70, 1.29], respectively).

Differences in transitions likelihood by level of empathy are presented in Figure 3. Patterns of findings were similar between low and high levels of empathy for all tested transitions, except for transitions from complex reflections to sustain talk. Whereas complex reflections were significantly more likely to be followed by sustain talk in sessions with low empathy ($OR = 1.89$ [1.08, 3.31]), this was not the case when empathy was high ($OR = 0.75$ [0.52, 1.08]) indicating that sustain talk was less likely after complex reflections, but not significantly). Findings were similar for MI spirit, but in these analyses complex reflections were significantly less likely to be followed by sustain talk when MI spirit was high ($OR = 0.66$ [0.45, 0.97]).

Insert Figure 3 here

Discussion

Our study provides interesting findings regarding the two main hypotheses of MI process, i.e., the technical and relational hypotheses (Miller & Rose, 2009). When considering the technical hypothesis, our models did not support the role of change talk as a mediator of the relationship between MI technical skills and changes in alcohol use. If this result is in contradiction with MI theory, it is consistent with results from recent meta-analyses (Magill et al., 2018; Pace et al., 2017) and particularly with studies of non-treatment seeking young adults and college students who use alcohol (Apodaca et al., 2014; Borsari et al., 2015; Gaume et al., 2013). Also consistent with MI process research among young adults, sustain talk was a predictor of worse outcomes. While MI theory might suggest that MI technique is designed to reduce client resistance, our results showed that open questions and simple reflections *increased* sustain talk, which was in turn related to more drinking at follow-up. However, this mediation pathway was only significant when relational skills (empathy and MI spirit) were low (conditional indirect effects). These results contribute to recent review literature suggesting low empathy as harmful (Moyers & Miller, 2013). In addition, these findings suggest a process where low relational proficiency, combined with more basic MI skills such as open questions and simple reflections could create a momentum for sustain talk. This is in line with other research with young adults (college students) showing that higher frequency of open questions (Tollison et al., 2013) and simple reflections (Tollison et al., 2008; Tollison et al., 2013) were associated with increases in drinking quantity at follow-up; in both studies, sessions were led by peer facilitators demonstrating only medium level of empathy and MI spirit. These findings also echoed studies where decisional balance exercises have been described as counterproductive (Carey et al., 2006;

Krigel et al., 2017), in particular when clients are ambivalent (Miller & Rose, 2015), which was the case in the present sample.

On the other hand, we found a significant conditional indirect effect for complex reflections when relational skills were *high* (i.e., more complex reflections related to *less* sustain talk, and indirectly, less drinking). This beneficial effect was supported by sequential analyses where complex reflections were the only MI behavior that was less likely to be followed by sustain talk when relational skills were high (i.e., significantly for MI spirit, and as a trend for empathy). This finding suggests that high quality reflective listening combined with high relational skills can reduce client resistance, as MI theory would propose. This beneficial effect contrasts with the detrimental effects of simple reflections discussed above. Other studies similarly showed differential effects of simple and complex reflections, as well as the superiority of the latter. In the study by Tollison and colleagues cited above (Tollison et al., 2008), the proportion of complex reflections attenuated the contraindicated effect of simple reflections in relation to student alcohol outcomes. A recent study by Brown and colleagues (2018) showed that complex reflections played a central role in eliciting change talk and were the only therapist behavior facilitating discussion of commitment to change, which has been shown to be a robust predictor of behavior change and thus a preferred target in MI (Amrhein, 2004; Miller & Rollnick, 2013; Miller & Rose, 2009).

In a recent study, Moyers and colleagues showed that clinicians' skills can reduce the amount of sustain talk their clients offer when considering a change in their substance use (Moyers et al., 2017). Within this study, clinicians who had received a specialized training to influence client change language had significantly lower sustain talk measured within actual treatment sessions compared to clinicians having received standard MI training. Moreover, mediation analyses supported a causal chain between training, providers' attempts to minimize sustain talk in treatment sessions via directive reflective listening, and client sustain

talk in the treatment session. This trial confirmed previous findings showing that client talk can be shaped by the therapist (D'Amico et al., 2015; Glynn & Moyers, 2010), but that it might require specific skills (e.g., selective reflection of change talk) and thorough training. Of note, there was no main effect of the specialized training in increasing change talk, as well as no mediation through change talk (Moyers et al., 2017). This might give additional strength to the hypothesis that MI skills have an effect through softening sustain talk, rather than through increasing change talk, at least among highly pre-contemplative samples.

Our study has several strengths such as a relatively high sample size for process research, a high follow-up rate, and high interrater agreement, as well as consistent patterns of findings in sensitivity analysis using distinct behavior count metrics (i.e., behavior percentages over the session instead of summed frequencies) and distinct analytical framework (i.e., session-level regression analysis and behavior-level sequential analysis). It might however be limited by some factors. First, our findings are generalizable to the specific context of a relatively brief, single MI session, among non-treatment seeking young men from the general population. Our study should be replicated in clinical samples and among older adults and adolescents. We observed that readiness to change was rather low and consistently that sustain talk was more frequent than change talk. Replication in a clinical setting might yield clients that are ready to change, and therefore express more change talk, eliciting a different kind of causal process.

Altogether, our findings call for attention to the motivational circumstances of individual behaviors, in the present study, the overall atmosphere of the session (i.e., measured as relational factors). Clinical implications highlight that clinicians should pay particular attention to sustain talk, especially with non-treatment seeking young adults. In our sample, high numbers of open questions and simple reflections had counterproductive effects, through increased sustain talk. Therapists should thus use these kinds of MI technical skills very

purposefully. On the other hand, a combination of high relational skills and complex reflections appear to facilitate an effective processing of sustain talk and subsequently, more positive outcomes. These skills thus appear as sound targets for training and supervision in MI.

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Figure 1

Moderated mediation models

Note. Significance levels estimated using a $p < .05$ threshold in OLS regression models for a , b , and c' paths. Significance levels estimated using bias corrected 95% confidence intervals on 5000 bootstrap samples for indirect effects. MI = Motivational interviewing; SD = standard deviation.

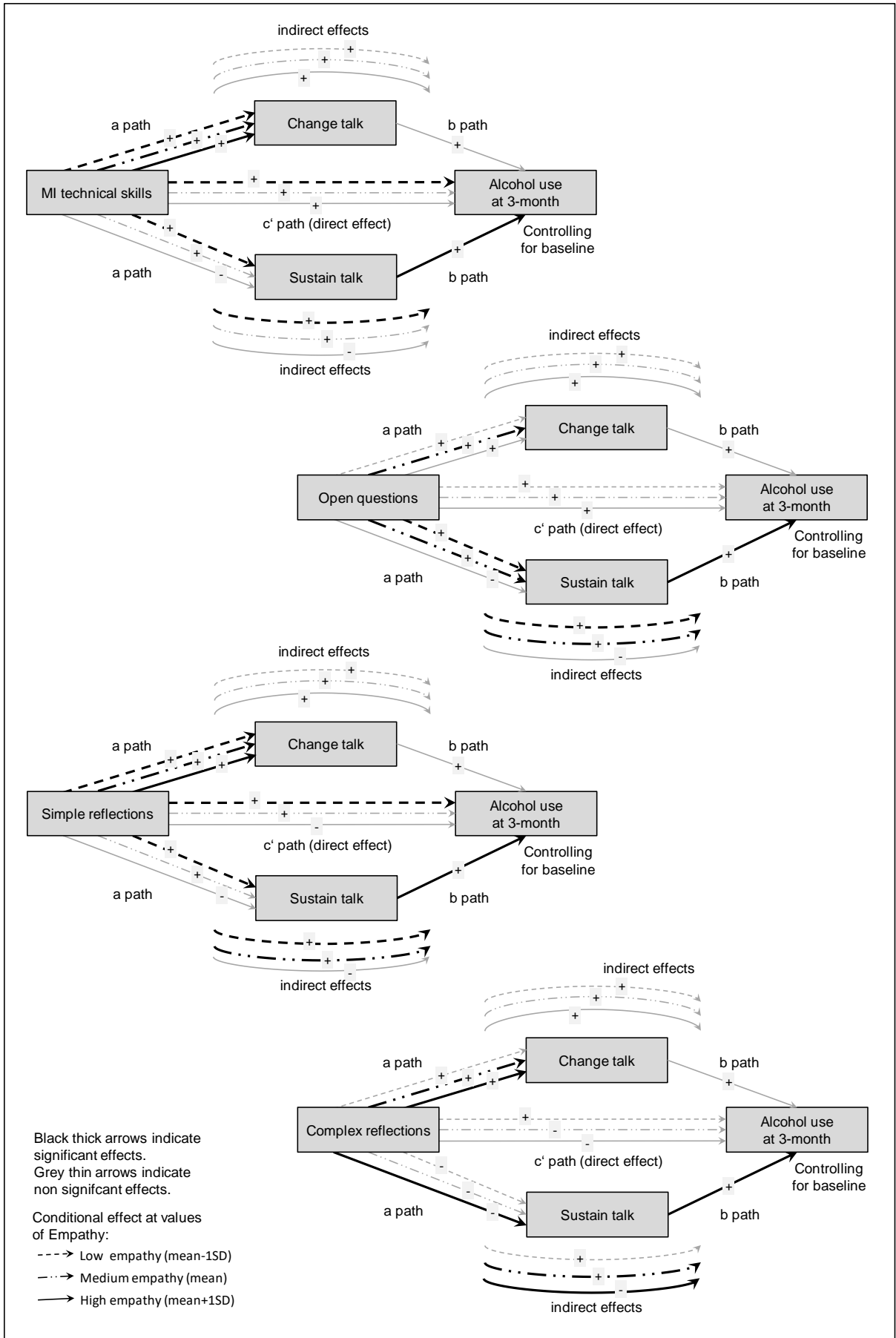


Figure 2

Graphical presentation of a paths moderated by levels of empathy

Note. Margins plots of linear prediction of frequency of sustain talk (y-axis). Values on the x-axis are the mean, plus or minus one standard deviation. Values for the moderator (level of empathy) are the mean (medium), plus (high) or minus one standard deviation (low).

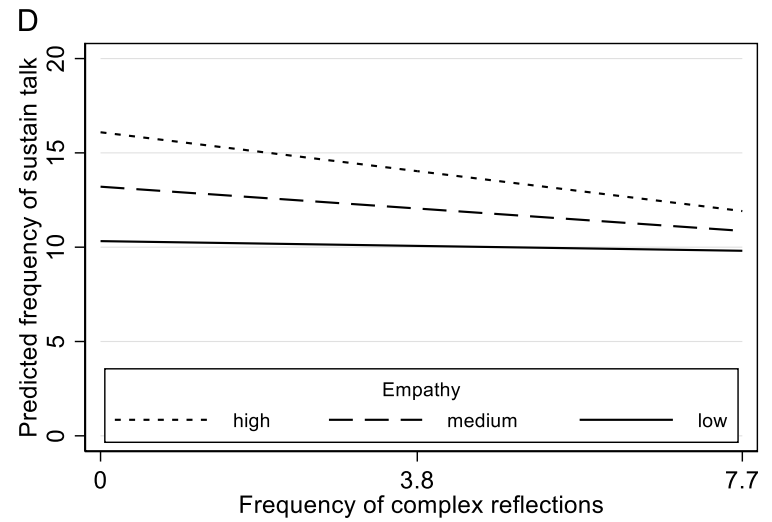
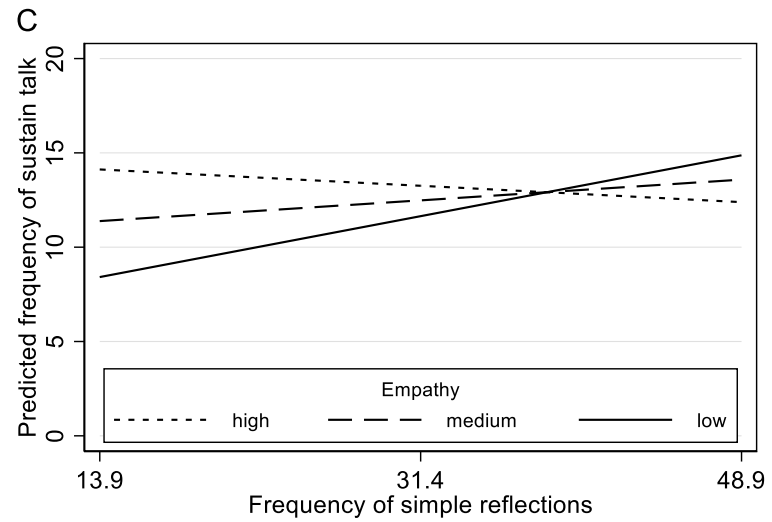
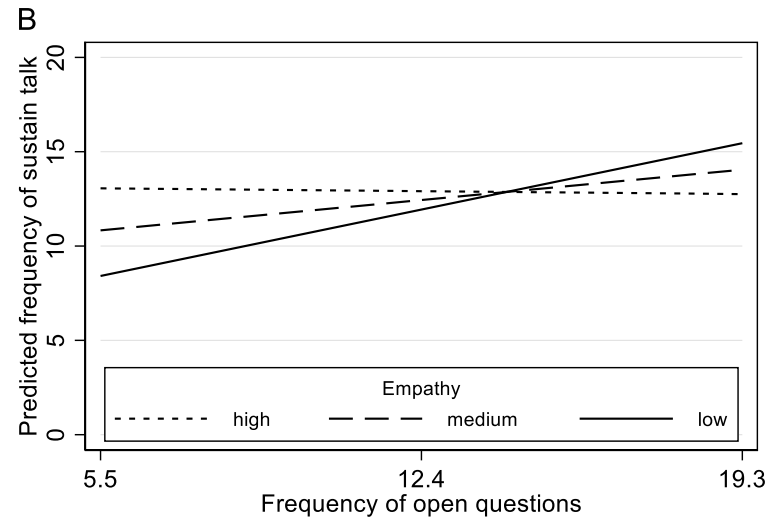
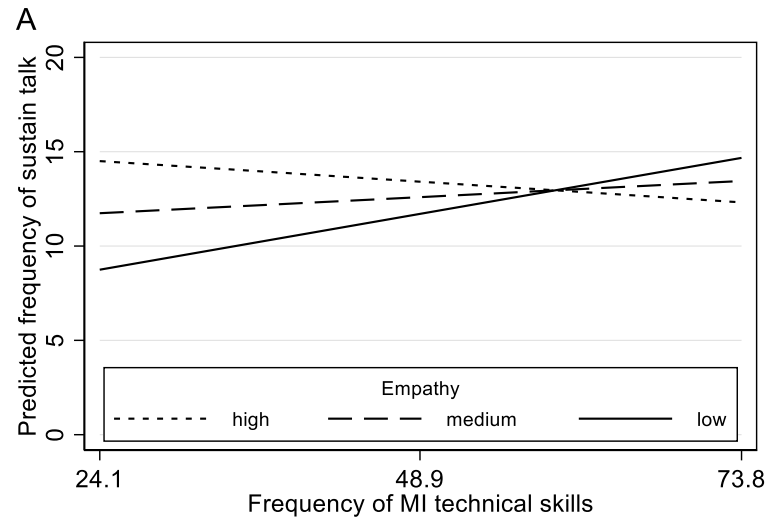


Figure 3

Transition likelihood from therapist MI behaviors to patient language depending on empathy level

Note. Odds ratios are indicated by diamonds and 95% confidence intervals by vertical lines. Odds ratios greater than 1 indicate that the observed therapist behavior is more likely than expected by chance to be followed by the observed client language variable; odds ratios smaller than 1 indicate that the transition is less likely than expected by chance. Low level of empathy (defined as ratings from 0 to 4) are depicted in light grey and high level (defined as ratings from 5 to 7) in dark grey. The bottom line of the x axis label indicates therapist MI skills and the line above indicates subsequent client language (e.g., the first diamond on the left indicates that therapists' MI technical skills were more likely than expected by chance to be followed by change talk among sessions where empathy was low).

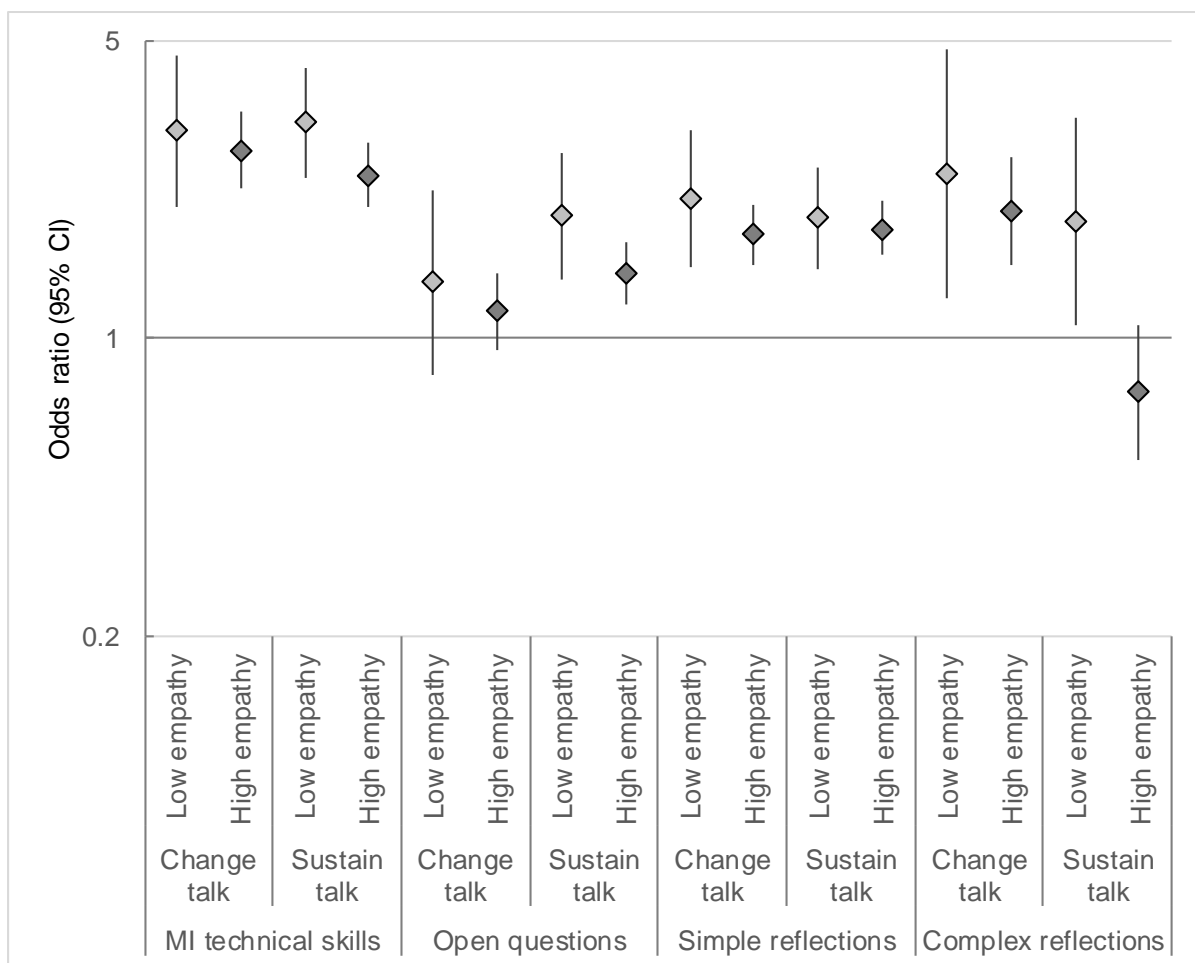


Table 1*Mediation models*

<i>a</i> path				<i>b</i> path				Indirect effects				
	<i>B</i>	<i>SE</i>	<i>p</i>		<i>B</i>	<i>SE</i>	<i>p</i>	<i>effect</i>	<i>SE*</i>	[95%	<i>CI</i>]*	<i>ES</i>
<i>Mediation model for MI technical skills</i>												
MI technical skills → Change talk	0.13	0.02	<0.0001	Change talk → Outcome	0.00	0.01	0.80	0.0002	0.0009	-0.0014	0.0020	0.08
MI technical skills → Sustain talk	0.03	0.03	0.20	Sustain talk → Outcome	0.02	0.01	0.001	0.0006	0.0005	-0.0001	0.0020	0.25
<i>Mediation model for Open questions</i>												
Open questions → Change talk	0.30	0.08	0.0004	Change talk → Outcome	0.00	0.01	0.72	0.0006	0.0020	-0.0026	0.0054	0.06
Open questions → Sustain talk	0.17	0.09	0.06	Sustain talk → Outcome	0.02	0.01	0.001	0.0030	0.0020	0.0004	0.0081	0.29
<i>Mediation model for Simple reflection</i>												
Simple reflection → Change talk	0.18	0.03	<0.0001	Change talk → Outcome	0.00	0.01	0.72	0.0004	0.0013	-0.0020	0.0029	0.13
Simple reflection → Sustain talk	0.06	0.04	0.08	Sustain talk → Outcome	0.02	0.01	0.001	0.0011	0.0008	0.0001	0.0032	0.35
<i>Mediation model for Complex reflections</i>												
Complex reflections → Change talk	0.61	0.15	0.0001	Change talk → Outcome	0.00	0.01	0.43	0.0029	0.0039	-0.0042	0.0122	N/A
Complex reflections → Sustain talk	-0.23	0.16	0.16	Sustain talk → Outcome	0.02	0.01	0.001	-0.0041	0.0029	-0.0118	0.0002	0.48

Note. MI = Motivational interviewing; SE = Standard error; CI = Confidence interval, ES = Effect size (ratio of the indirect effect to the total effect).

* Estimated on 5000 bootstrap samples.

Table 2*Conditional indirect effects at different levels of empathy*

	<i>effect</i>	<i>SE*</i>	<i>[95%</i>	<i>CI]*</i>	<i>ES</i>		<i>effect</i>	<i>SE*</i>	<i>[95%</i>	<i>CI]*</i>	<i>ES</i>
Independent variable: MI technical skills											
Mediator: Change talk						Mediator: Sustain talk					
Low empathy	0.0002	0.0007	-0.0010	0.0019	0.05	Low empathy	0.0021	0.0010	0.0006	0.0047	0.23
Medium empathy	0.0002	0.0007	-0.0011	0.0017	0.09	Medium empathy	0.0007	0.0006	-0.0001	0.0022	0.13
High empathy	0.0002	0.0007	-0.0013	0.0018	0.33	High empathy	-0.0008	0.0006	-0.0023	0.0001	N/A
Independent variable: Open questions											
Mediator: Change talk						Mediator: Sustain talk					
Low empathy	0.0006	0.0019	-0.0022	0.0060	0.07	Low empathy	0.0090	0.0043	0.0025	0.0199	0.34
Medium empathy	0.0004	0.0015	-0.0017	0.0048	0.07	Medium empathy	0.0043	0.0025	0.0007	0.0110	0.25
High empathy	0.0003	0.0013	-0.0012	0.0047	0.07	High empathy	-0.0005	0.0017	-0.0038	0.0032	N/A

Independent variable:
Simple reflections

Mediator: Change talk

Mediator: Sustain talk

Low empathy	0.0003	0.0010	-0.0012	0.0028	0.06	Low empathy	0.0033	0.0015	0.0010	0.0069	0.23
Medium empathy	0.0003	0.0010	-0.0016	0.0025	0.14	Medium empathy	0.0012	0.0008	0.0001	0.0033	0.20
High empathy	0.0004	0.0011	-0.0019	0.0027	N/A	High empathy	-0.0009	0.0009	-0.0031	0.0006	0.38

Independent variable:
Complex reflections

Mediator: Change talk

Mediator: Sustain talk

Low empathy	0.0016	0.0032	-0.0019	0.0129	0.33	Low empathy	-0.0012	0.0048	-0.0123	0.0080	N/A
Medium empathy	0.0019	0.0028	-0.0023	0.0096	N/A	Medium empathy	-0.0053	0.0035	-0.0145	-0.0001	0.98
High empathy	0.0023	0.0033	-0.0025	0.0121	N/A	High empathy	-0.0094	0.0040	-0.0197	-0.0032	0.68

Note. Bold characters indicate significant conditional indirect effects. MI = Motivational interviewing; SE = Standard error; CI = Confidence interval; SD = Standard deviation, ES = Effect size (ratio of the indirect effect to the total effect). Values for the moderator (level of empathy) are the mean (medium), plus (high) or minus one SD (low).

* Estimated on 5000 bootstrap samples.

Data Transparency Appendix

The data reported in this manuscript have been collected as part of a larger data collection and findings from the data collection have been reported in separate manuscripts. Specifically, data for the present analysis were drawn from a randomized controlled trial of brief MI among hazardous drinkers included within the Army Recruitment Center of Lausanne, Switzerland. The study was registered in the ISRCTN registry (<https://www.isrctn.com/ISRCTN92486583>). The study aimed at investigating the influence of therapist' characteristics and within-session behaviors on brief MI efficacy.

Main effects of the intervention as well as influence of therapist' characteristics and behaviors were published in a first article (Gaume et al., 2014). Therapists' behaviors involved MI technical and relational skills reported in the present analysis, but coded differently (i.e., dichotomized at the median vs. continuous in the present analyses).

A second paper (Gaume, Magill, et al., 2016) examined the predictive validity of client change talk on change in alcohol use. This paper focused on strength levels of change talk, but also included frequency of change talk and sustain talk reported in the present analysis.

In a third paper (Gaume, Longabaugh, et al., 2016), we used moderated mediation models to test whether therapist and client characteristics moderated the role of change talk in brief MI. The analytical framework was similar, but moderators are different. Also, we went a step further in the present analyses by further exploring the most frequent MI technical skills (i.e., open questions, simple and complex reflections, vs. overall MI technical skills only in the former analysis), and by exploring change talk and sustain separately (vs. a continuous scale of strength of change talk).

The combination of MI technical skills, change and sustain talk, drinking outcomes and relational skills has never been investigated nor published elsewhere. The present findings

were presented in a poster at an international scientific conference, and in an oral presentation at another.

Appendix references

Gaume, J., Longabaugh, R., Magill, M., Bertholet, N., Gmel, G., & Daepfen, J. B. (2016).

Under what conditions? Therapist and client characteristics moderate the role of change talk in brief motivational intervention. *J Consult Clin Psychol*, *84*(3), 211-220.

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