Brief alcohol intervention for general hospital inpatients: A randomized controlled trial

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Abstract

Aim: To test the effectiveness of a brief alcohol intervention among non-dependent general hospital inpatients with alcohol problems, delivered by either a specialized liaison service or hospital physicians.

Method: All inpatients of 29 wards from four general hospitals of one region in Germany were screened for alcohol problems ($n = 14,332$). Of those screening positive, 595 patients were included in a randomized controlled group design using a time-frame. Patients with alcohol dependence were not considered in this study. Patients received Motivational Interviewing based counselling either by a specialized liaison service, by hospital physicians trained under routine conditions or received hospital treatment as usual without additional counselling. One year later, alcohol consumption, motivation and well-being were assessed. Sample survey analyses and generalized estimating equations were conducted.

Results: At baseline, the three groups differed regarding motivation, with higher motivation among the controls. At follow-up, the groups did not differ regarding alcohol consumption, alcohol-related problems and well-being. All groups decreased their alcohol consumption significantly. Regarding motivation, longitudinal analyses revealed significant interaction effects of time and intervention ($p < 0.05$), indicating a stronger increase of readiness to change drinking and a less profound drop of readiness to seek help among those who received intervention compared to the controls.

Conclusion: The intervention was not effective in reducing alcohol consumption or in increasing well-being 12 months after hospitalization. It had a positive effect on readiness to change drinking and on readiness to seek formal help for alcohol problems. The intervention groups compensated their lag of motivation.

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1. Background

Hospitalization for alcohol-associated injury or disease provides a "teachable moment" due to increased motivation to change drinking (Longabaugh et al., 1995; Rumpf et al., 1999), suggesting that brief alcohol interventions (BAI) might reduce drinking in general hospital patients. However, while BAI are effective in reducing alcohol consumption and alcohol-related

problems in outpatient primary care settings (Bien et al., 1993; Ashenden et al., 1997; Bertholet et al., 2005; D'Onofrio and Degutis, 2002; Freemantle et al., 1993; Fleming and Manwell, 1999; Wilk et al., 1997; Kahan et al., 1995; Moyer et al., 2002), the evidence for the effectiveness of BAI among general hospital inpatients is inconclusive (Emmen et al., 2004). Of eight clinical controlled trials on the effectiveness of BAI among general hospital inpatients, three studies reported intervention effects regarding alcohol consumption (Antti-Poika et al., 1988; Heather et al., 1996; Welte et al., 1998), three studies reported intervention effects regarding alcohol-related problems but not for alcohol consumption (Chick et al., 1985;

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Elvy et al., 1988; Rowland and Maynard, 1993), and two studies did not find any intervention effects (Saitz et al., 2007; Watson, 1999). The effectiveness of BAI decreases with severity of alcohol problem, namely alcohol dependence, indicating that BAI are particularly promising with non-dependent problem drinkers (Moyer et al., 2002). Thus, one reason for the inconclusive evidence might be that BAI have addressed inpatients with alcohol dependence who may require expanded interventions such as additional check-up visits (as described in Antti-Poika et al., 1988). Large representative samples of general hospital inpatients with alcohol problems other than alcohol dependence are needed to test the effectiveness of BAI.

Individuals with alcohol problems such as alcohol abuse (APA, American Psychiatric Association, 1995), at-risk drinking or heavy episodic drinking could be in the focus of BAI. According to the British Medical Association (BMA, 1995), at-risk drinkers are characterized by an average daily consumption of 20 g of pure alcohol or more for women and 30 g or more for men. Heavy episodic drinkers are characterized by irregular excessive alcohol consumption, e.g. of more than 65 g for women and 100 g for men of pure alcohol (Babor and Grant, 1992). Both have a higher risk for somatic problems, in particular heavy episodic drinkers experience a higher rate of injuries and accidents (Gmel et al., 2003; BMA, 1995).

Motivational interviewing (MI, Miller and Rollnick, 2002) is a promising approach to reduce alcohol consumption among individuals with alcohol problems (Hettema et al., 2005; Vasilaki et al., 2006). Two studies that applied MI based brief interventions in general hospital patients with alcohol problems show mixed results. One study supports its efficacy (Heather et al., 1996) and one does not (Saitz et al., 2007). We also lack knowledge on the effect of MI based interventions on motivation (Vasilaki et al., 2006; Allsop, 2007).

It has been discussed whether or not the efficacy of BAI varies by whom it is delivered. For example, Saitz et al. (2007) discussed that "... the intervention group might have fared better if a medical clinician had provided the intervention" (p. 174). From general practices we know that physicians and specialized nurses are equally successful in delivering brief advice for at-risk drinkers (Babor et al., 2006). To identify the most promising procedure in general hospitals, a study investigating the effectiveness of BAI delivered by physicians vs. by a specialized addiction service is needed.

The purpose of this study was to test the effectiveness of a MI based brief intervention among inpatient non-dependent problem drinkers in general hospitals. Effectiveness was measured by alcohol consumption, alcohol-related problems, motivation and well-being. We also aimed to investigate whether the effectiveness of a MI based brief intervention differs by whom it is delivered.

2. Methods

2.1. Recruitment

This paper reports findings of the randomized controlled trial "Implementing early intervention for alcohol misuse in the general hospital" (registered in ClinicalTrials.gov: NCT00423904), conducted by the Research Collaboration on Early Substance Use Intervention (EARLINT) between 28-04-2002 and 30-06-2004. The local ethics committee of the Ernst-Moritz-Arndt-University of Greifswald approved of the study. Data were collected at four general hospitals in Western Pomerania in Northeastern Germany. Permission was obtained from all hospitals. The four hospitals provide the medical care for 198,745 inhabitants of a comprised geographical region (Statistisches Landesamt, 2005), with two urban sites (59,140 and 52,869 inhabitants) and two rural sites (12,754 and 8383 inhabitants) (Statistisches Landesamt, 2004). A total of 29 wards including internal medicine, surgical medicine, dermatology, orthopedy as well as ear, nose and throat units were included.

The participants were recruited using a two-stage-sampling (screening and diagnostic). First, all patients admitted were asked to consent to an alcohol screening; the inclusion criteria being individuals between 18 and 64 years old with a minimum hospital stay of 24 h. Patients not cognitively or physically capable, patients already recruited for the study during an earlier hospital stay, patients with language barriers, and patients employed at the hospital were excluded from the study. The physicians or nurses of the wards informed the study staff about patients who were cognitively or physically incapable of participating in the study.

The screening consisted of the German adaptation of the Alcohol Use Disorder Identification Test (AUDIT, Saunders et al., 1993) and the Luebeck Alcohol Dependence and Abuse Screening Test (LAST, Rumpf et al., 1997), with cutoff values of eight and two, respectively. To increase the detection rate of patients with alcohol problems, the LAST, a specific and sensitive screening measure for alcohol abuse and dependence, was used in addition to the AUDIT.

Individuals with a positive screening result on at least one of the two measures were then assessed to identify alcohol dependence (AD), alcohol abuse (AA), at-risk drinking (AR) and heavy episodic drinking (HE) in descending hierarchical order. AD and AA were diagnosed using the German adaptation of the Composite International Diagnostic Interview (M-CIDI, Lachner et al., 1988; Wittchen and Pfister, 1997). The M-CIDI provides DSM-IV diagnoses (APA, 1995). Its alcohol section isolates current (past 12 months) from prior alcohol abuse and dependence (sustained remission). Individuals meeting criteria for current AD were excluded from the analyses presented in this article. AR was determined by a quantity-frequency-index based on the conventions of the BMA (1995) described above. According to Babor and Grant (1992), HE was assessed with the question "How often within the past 12 months did you drink five (for women) or eight (for men) drinks on one occasion?". Individuals reporting at least twice a month of drinking above this criterion were considered heavy episodic drinkers, and were included in this study. On average the diagnostic interview lasted 22 min (S.D. = 9). Individuals with current alcohol problems were asked for informed consent for further study participation. Directly after obtaining informed consent, all participants received standardized questionnaires, with a mean duration of 31 min (S.D. = 10). While the screening was self-administered, the diagnostic interview and the standardized questionnaires were performed by the staff of the study (three psychologists, two social workers, two research nurses) trained in conducting standardized diagnostic interview and questionnaires.

To assign participants to the three study groups, randomization was conducted by time-frame, based on the date of admission. The time-frame is a widely used randomization procedure in general hospital studies (Chick et al., 1985; Heather et al., 1996). Each condition was planned to last 4 months, starting with the control group (C), intervention group "liaison service" (IL) and finally intervention group "physicians" (IP). The time-frame was used to prevent patients of different study conditions from exchanging intervention information, and to prevent physicians from applying the newly learned MI skills to participants from C or IL. The number of weeks needed for recruitment of participants, was highest for IP (M = 41, range: 12–57), followed by IL (M = 27, range: 11–30) and C (M = 23, range: 16–40). The increased number of weeks for recruitment for IP was due to the number of re-admissions that was increasing drastically over time, and to the dropout of eight wards. Seven wards were excluded due to restructuring of the hospitals (e.g. ward closed down) and one ward (dermatology) did not provide sufficient participants. Due to the study design, the staff was not blind to the study group to which the participants had been assigned.

2.2. Intervention

Intervention in both intervention groups was based on MI and on the Transtheoretical Model of behaviour change (TTM, Prochaska and Velicer, 1997; Prochaska and DiClemente, 1984). In addition, both intervention groups received a brochure called "Alcohol and health".

Participants in the intervention group "liaison service" received counselling by the same person who conducted the assessment. The mean duration of the counselling session was 25 min (S.D. = 14, range: 5–80). The aim of the intervention was to increase motivation to change the alcohol problem behaviour such as driving while intoxicated or the volume of drinking. The intervention was adapted to the participants' situation, depending on their readiness to change drinking, and their type of alcohol problem (alcohol abuse, at-risk drinking and/or heavy episodic drinking). The intervention included strategies such as exploring advantages and disadvantages of drinking, giving information on drinking at safe limits, supporting self-efficacy, and creating a change plan if individuals were ready to do so. Each counsellor received 24 h of introductory and advanced training in MI by the principal investigator UH, a member of the Motivational Interviewing Network (MINT). Supervision was conducted every 2–3 weeks using digital audio recordings of the counselling sessions. Prior counselling experience was heterogeneous among the counsellors. Three counsellors were psychologists with clinical experience ranging between 1 and 3 years; and one counsellor was a social worker who had worked as an addiction counsellor for 7 years before joining the research team.

For the intervention group "physicians", all physicians (including residents) of the participating wards were offered a MI based training by UH and KP, both members of the MINT. As a standardized training was impossible due to organizational reasons, the physicians were trained under routine conditions. The heads of the hospitals agreed to introductory courses with time limits of 30–120 min. Of a total of 110 physicians, 32 participated in these courses. A variety of additional training methods were used to teach the physicians how to apply MI-strategies. According to Rollnick, Kinnersley and Butler (2002), a context-bound training was used to deliver the training in the physicians' workplace. Sixteen physicians were trained during the ward round, 44 physicians received one or two trainings that were conducted individually or in small groups, 5 physicians were supervised in certain cases, and 75 physicians received a counselling kit. Eighty (73%) of the 110 physicians were trained using one or more of these training methods. For the intervention, the interviewers forwarded counselling relevant information to the physicians using a contact protocol. The protocol included information on quantity and frequency of drinking, readiness to change, type of alcohol problem, and information that the interviewer regarded as relevant for counselling. The use of assessment data for intervention is an usual procedure in the field of BAI (e.g. Hester et al., 2005). To monitor the physicians' interventions, they were asked to return the protocols with information regarding the intervention. As the evaluation of the protocols was not possible due to substantial missing data, we cannot reliably describe the interventions provided by the physicians, e.g. regarding the duration of the intervention or techniques that were used.

The control group received treatment as usual without additional intervention. The ward physicians and nurses were neither discouraged nor encouraged to advise the patients to modify their alcohol consumption.

2.3. Follow-up

Follow-up interviews were conducted 12 months after baseline ($M = 390$ days, S.D. = 48 days). The interviews were generally conducted at the participants' homes. If participants lived outside the study area (23,200 km^2), they were interviewed by phone. Sixty-two percent of the participants had different interviewers at baseline and at follow-up. Two reasons made it difficult to have different persons interviewing each participant: (a) each interviewer covered a certain region of the total study area, and (b) some participants preferred to be interviewed by the same interviewer. As they did not receive any incentives, a compromise had to be made to ensure further participation.

2.4. Outcome measures

2.4.1. Alcohol consumption and problems.
The outcome analysis was based on self-report measures. Six variables assessing alcohol consumption and related problems were used as outcomes: average daily alcohol intake, total alcohol intake in past week, heavy episodic drinking, at-risk drinking, alcohol abuse, and having any alcohol problem at follow-up.

Daily alcohol intake was assessed using the quantity-frequency questions of the M-CIDI. Frequency of alcohol consumption was assessed using five categories: almost daily, 3–4 times a week, 1–2 times a week, 1–3 time a month, less than once a month. The assessment of quantity was supported by a visual aid showing standard alcoholic beverages. One standard drink was converted into 9 g of pure alcohol. Outliers regarding daily alcohol consumption were determined using the formula $M + 3$S.D. Cases above the threshold values of 295.39 g at baseline (eight outliers) and 265.30 g at follow-up (nine outliers) were assigned these scores as maximum consumption. Due to skewed data, the variable was log transformed for analyses.

Alcohol intake in past week was measured at follow-up only. Using a Timeline-Followback for the past 7 days (according to Sobell and Sobell, 2003), participants reported the type of beverage and quantity of alcohol consumed on each day of the week prior to the interview. The total intake of pure alcohol in gram for that week is reported.

At follow-up, according to the diagnostic procedure at baseline, heavy episodic drinking, at-risk drinking and alcohol abuse were assigned, when criteria for theses problems were met in the past 12 months. Individuals meeting criteria for any of these problems or alcohol dependence were considered as having an alcohol problem. In contrast to baseline, the 12-month version of the M-CIDI's alcohol section was applied at the 12-month follow-up.

2.4.2. Motivation and well-being.
Two aspects of motivation were assessed by the Readiness to Change Questionnaire (RCQ, Rollnick et al., 1992) and by the Treatment Readiness Tool (TReaT, Freyer et al., 2004). Both measures are based on the TTM and permit the assignment to one stage of motivation (Precontemplation, Contemplation or Action/Preparation). They are short, reliable and valid measures, developed in general hospital settings. The RCQ assesses readiness to change drinking. The TReaT assesses readiness to seek formal help for alcohol problems, including professional treatment, counselling and self-help groups. At follow-up, individuals who reported complete abstinence from alcohol since baseline ($n = 45$) did not receive the RCQ. They were considered to be in Action. For this study, regarding both measures, individuals in Precontemplation or Contemplation were combined to one group "not ready" and individuals in Action or Preparation were considered as "ready" (Freyer et al., 2005).

Satisfaction with life was measured using the subscale "Satisfaction with life domains" of the Health Behaviour Questionnaire (Dlugosch and Krieger, 1995). Eight items ask for satisfaction in various life domains (e.g. job, marriage, living, finances, health) on a five-point-Likert scale ranging from "not at all satisfied" (0) to "extremely satisfied" (4).

Mental health was assessed by the Mental Health Inventory (MHI-5, Berwick et al., 1991). The MHI-5 is a sensitive and valid screening instrument to detect mood and anxiety disorders in the general population (Rumpf et al., 2001). It consists of five items (e.g. "How much of the time during the last month have you . . . e.g. been a happy person?") and a five-point-Likert scale, ranging from "none of the time" (0) to "all of the time" (4), with the total score indicating mental health.

Self-rated health was assessed at follow-up only. The single item "Would you say your health in general is: excellent (1), very good, good, fair, poor (5)?" is known to be an independent predictor of mortality (Idler and Benyamini, 1997).

2.5. Statistical analyses

In the first stage we analysed differences with respect to potential baseline differences among the three study groups. To take into account clustering within hospital and wards we applied the sample survey methods (LaVange et al., 2001) in Stata Intercooled 9.2 (StataCorp, 2005), with hospital ($n = 4$) as strata and ward ($n = 29$) as primary sampling unit. Linear and logistic regression analyses were conducted for continuous and categorical variables, respectively. To identify differences between all three groups, all analyses were conducted twice with exchanged reference groups.

In the second stage of the analysis, associations between study conditions and outcome measures were estimated using linear and logistic generalized estimating equation (GEE). GEE regression models with working compound
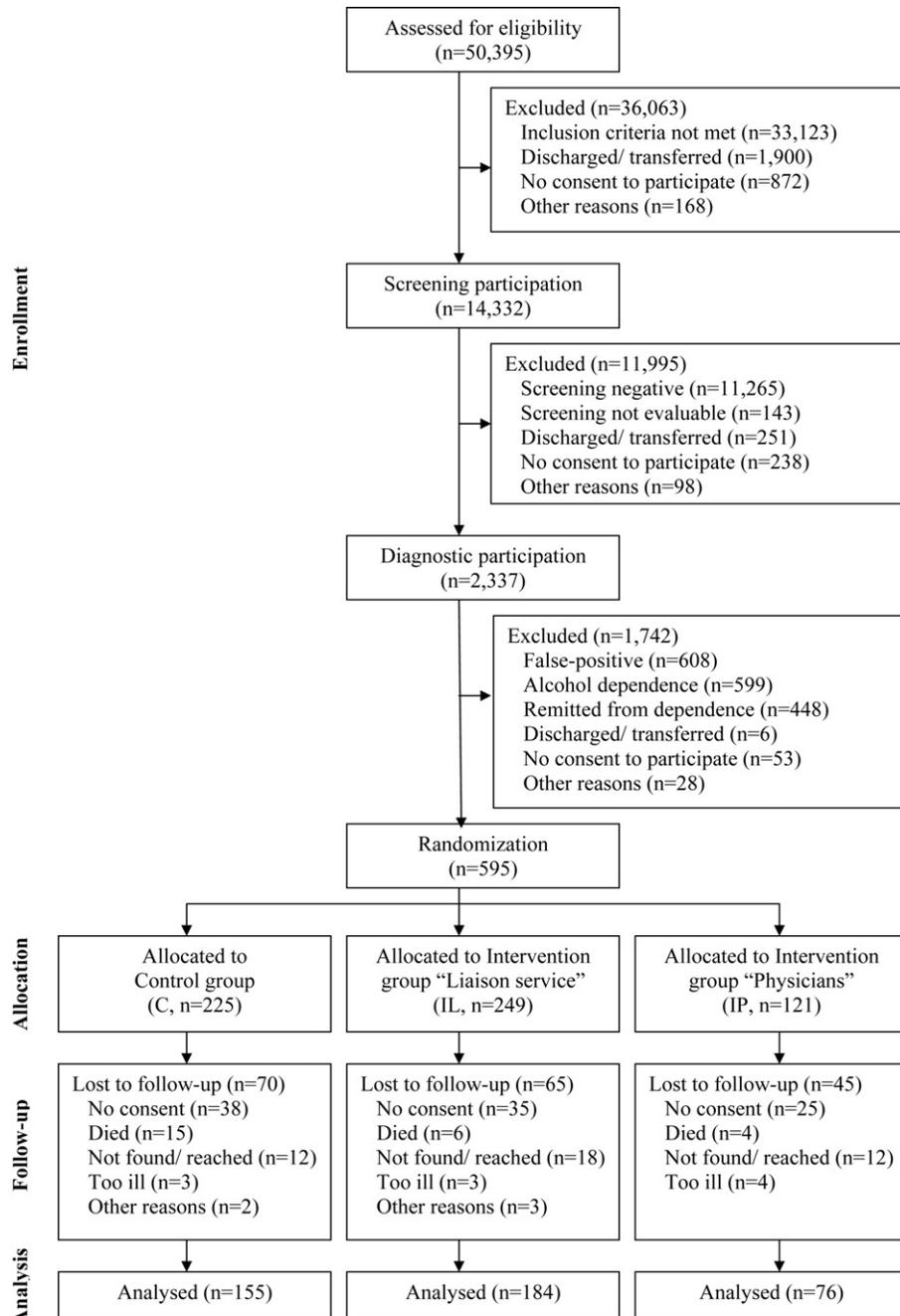
Fig. 1. Flow-chart according to the CONSORT statement.

symmetry correlation structure and robust variance estimators were computed. Due to the small sample size in the intervention group "physicians" ($n = 76$), both intervention groups were combined to one group (any intervention, I). Subjects with missing values were deleted list-wise.

3. Results

3.1. Sample description

The flow-chart according to the CONSORT statement (Moher et al., 2001) is presented in Fig. 1. A total of 14,332 patients were screened. For 20% ($n = 2924$) of these, a positive screening result was identified on at least one of the two

measures. Of these, 80% ($n = 2337$) agreed to participate in a diagnostic interview. A total of 1281 patients met criteria for AD, AA, AR or HE in the past year. Individuals with AD ($n = 599$) were excluded from the following analyses. Of the remaining 682 non-alcohol dependent patients with AA, AR or HE, 87% ($n = 595$) consented to become a study participant. One year later, 70% ($n = 415$) of the participants were followed-up, 4% ($n = 25$) had died, and the rest was lost due to refusal of further study participation ($n = 98$) or other reasons ($n = 57$).

Baseline differences between the follow-up sample ($n = 415$) and the sample not followed-up ($n = 180$) were analysed using sample survey analyses. Participants in the follow-up sample reported more years of school ($F[1,25] = 12.33$, $p < 0.01$).

No significant differences ($p < 0.05$) were found for gender, age, intimate partner, employment status, AUDIT score, LAST score, type of alcohol problem and satisfaction with health. The assumption of missing completely at random was tested by regressing dropout at follow-up on all outcome variables and their interactions with school. This analysis revealed that neither baseline characteristics nor the interactions were predictors of dropout, indicating that exclusion of the sample not followed-up is appropriate for further analyses.

The mean age at baseline was 41 years, 94% were male, 65% had an intimate partner, 48% had 10–11 years of school, and 45% were employed (Table 1). Twenty-five percent were alcohol abusers, 57% at-risk drinkers, and 18% heavy episodic drinkers. The mean scores for the AUDIT and the LAST were 12.2 and 2.3, respectively. Between group differences were found for satisfaction with health, age and having an intimate partner. The three study groups did not significantly differ regarding alcohol variables.

3.2. Sample survey analyses at baseline and follow-up

Group differences between the three study groups (C, IL, IP) and among C and I were analysed using sample survey analyses. None of the group comparisons regarding alcohol consumption were significant, neither at baseline nor at follow-up (Table 2). For example, regardless of group affiliation, 42–46% of all participants no longer met criteria for alcohol problems at follow-up.

In terms of motivation, baseline differences were found for readiness to seek help (Table 3). Compared to both intervention groups, significantly more controls were ready to seek help (24% vs. 11%, 9%). This advantage for the controls disappeared at follow-up (10% vs. 8%, 9%). No significant differences were found for readiness to change and well-being, neither at baseline nor 12 months later.

3.3. Longitudinal analyses

Two models were tested for each longitudinal outcome. The first model included the outcome variable only. The second model adjusted for clustering at hospital level, controlled for gender, baseline differences (school, age, intimate partner, satisfaction with health, TReaT), and severity of alcohol problem (LAST score). The TReaT was not included as a covariate in the model testing readiness to change. The LAST score was included, as its mean score of 2.3 exceeded the cut-off value of 2, indicating that the sample may contain individuals who are either on the verge of developing alcohol dependence, who denied symptoms of alcohol dependence, or who met criteria for alcohol dependence in the past. As BAI are less effective for alcohol dependent persons (Moyer et al., 2002), we decided to control for alcohol problem severity as well.

The analyses revealed time effects for six of the eight outcome variables. Alcohol consumption (daily alcohol intake, heavy episodic drinking, at-risk drinking) and alcohol abuse decreased, and readiness to seek help and life satisfaction increased significantly over time (Table 4). Readiness to change and mental health did not change over time. Between group effects were found for both measures of motivation. When including the covariates, interaction effects between time and group were significant, indicating a more profound drop of readiness to seek help among the controls (OR = 2.90, 95% CI: 1.06–7.95, $p = 0.038$), and a stronger increase of readiness to change drinking in the intervention group (OR = 2.11, 95% CI: 1.03–4.33, $p = 0.041$).

To better depict transition across the two levels of motivation "ready" and "not ready" from baseline to follow-up, cross tables are presented in Table 5. For example, in the intervention group, 67% ($n = 51$) of the individuals who were ready to change at follow-up had proceeded from "not ready" to "ready"; that is 18% more compared to the control group (49%, $n = 22$). In the intervention group, 76% ($n = 15$) of the individuals ready to seek help at follow-up had proceeded from "not ready" to "ready"; that is 57% more compared to the control group (19%, $n = 3$). In the intervention group, 9% of the individuals not ready at follow-up were ready at baseline ($n = 21$); that is 9% less compared to the control group (18%, $n = 24$).

4. Discussion

The study's aim was to investigate the effectiveness of a MI based brief intervention among non-alcohol dependent general hospital inpatients with alcohol problems. Two ways of delivery were tested: motivational counselling by a specialized liaison service or by hospital physicians.

At follow-up no significant differences in alcohol consumption and related problems were found between the intervention groups and the controls, indicating that the intervention had no effect regarding alcohol use. As found in previous studies (Chick et al., 1985; Rowland and Maynard, 1993; Watson, 1999), all groups whether or not they had received intervention decreased their alcohol consumption after hospitalization. Three explanations are likely. Firstly, in contrast to outpatients from general practices for which positive intervention effects were found (Bertholet et al., 2005), inpatients experience more severe somatic diseases or injuries requiring hospitalization which may initiate self-change. This hypothesis is supported by the high self-change rate found in this study. One year after hospitalization, 46% of the controls did not report any alcohol problem, and their daily alcohol consumption was reduced by one third (24 grams of pure alcohol). Secondly, our extensive assessment at baseline that lasted 53 min on average and dealt with drinking behaviour as well as motivational aspects of behaviour change, may have concealed therapeutic benefit (Kypri et al., 2007). Thus, it might be argued that all participants had received some form of minimal intervention. Future studies should be alert of this assessment problem and consider minimal assessments instead. Thirdly, "regression to the mean", an effect that is caused by normal changes in alcohol use over time, may have been responsible for the controls' reduced alcohol consumption (Fleming and Manwell, 1999). It is likely that some patients were hospitalized due to alcohol-related diseases or injuries at time points at which their alcohol use was abnormally high. In the

Table 1
Baseline characteristics stratified by study condition

Variables	Total (n = 415)		Control (C, n = 155)		Intervention Liaison (IL, n = 184)		Intervention Physician (IP, n = 76)		Sample survey analyses[a]		
									F (d.f.)	p	Differences[b]
Demographic variables											
Gender (N, % male)	390	93.98	145	93.55	173	94.02	72	94.74	0.10 (2, 23)[c]	0.904	Ns
Age (M, S.D.)	41.05	12.60	40.40	12.40	42.52	12.12	38.80	13.79	2.72 (2, 23)[d]	0.087	IL > IP*
Intimate partner (N, % yes)	261	64.60	92	62.59	127	70.17	42	55.26	2.84 (2, 23)[c]	0.079	IL > IP*
School in years (N, %)											
<10	138	33.99	55	36.18	58	32.22	25	33.78	0.27 (2, 23)[c]	0.767	Ns
10–11	194	47.78	71	46.71	92	51.11	31	41.89			
>11	74	18.23	26	17.11	30	16.67	18	24.32			
Employment status (N, %)											
Full/halftime	178	44.50	66	44.00	77	44.00	35	46.67	0.74 (2, 23)[c]	0.489	Ns
Job-seeking	131	32.75	50	33.33	62	35.43	19	25.33			
Others[e]	91	22.75	34	22.67	36	20.57	21	28.00			
Alcohol variables											
LAST (M, S.D.)	2.33	1.51	2.38	1.52	2.24	1.50	2.43	1.52	0.33 (2, 23)[d]	0.720	Ns
AUDIT (M, S.D.)	12.23	5.44	12.89	5.47	11.71	5.34	12.17	5.56	1.34 (2, 23)[d]	0.281	Ns
Alcohol problem (N, %)[f]											
Alcohol abuse	104	25.06	40	25.81	42	22.83	22	28.95	0.68 (2, 23)[c]	0.515	Ns
At-risk drinking	238	57.35	86	55.48	109	59.24	43	56.58			
Heavy episodic drinking	73	17.59	29	18.71	33	17.93	11	14.47			
Health satisfaction (M, S.D.)[g]	1.90	1.23	1.72	1.22	1.97	1.24	2.07	1.18	3.99 (2, 23)[d]	0.031	C < IL*, IP*

Ns: non-significant.

[a] Strata: hospital, primary sampling unit: ward.

[b] Analyses were conducted twice with exchanged reference groups.

[c] Multinomial logistic regression.

[d] Linear regression.

[e] Retired, students, housewives.

[f] In descending hierarchical order.

[g] Assessed by one item of the "Satisfaction with life domains" scale.

* $p < 0.05$.

Table 2
Alcohol-related outcome measures at baseline and at follow-up

Variables	Time	Control (C, n = 155)		Intervention Liaison (IL, n = 184)		Intervention Physician (IP, n = 76)		Any Intervention (I, n = 260)		Differences[a] C vs. IL vs. IP[b] C vs. I
Gram alcohol (M, S.D.)										
Per day	Baseline	70.15	63.49	61.30	49.31	57.81	47.64	60.28	48.76	Ns[c]
	12 months	46.32	59.33	42.10	56.22	38.18	43.45	40.95	52.76	Ns[c]
In past week	Baseline	–	–	–	–	–	–	–	–	–
	12 months	274.01	344.09	255.39	346.15	266.27	355.53	258.46	348.14	Ns[c]
Problem (N, % yes)										
Alcohol abuse	Baseline	40	25.81	42	22.83	22	28.95	64	24.62	Ns[d,e]
	12 months	14	9.03	15	8.15	9	11.84	24	9.23	Ns[d,e]
At-risk drinking	Baseline	112	72.73	135	73.77	55	73.33	190	73.64	Ns[d,e]
	12 months	68	44.16	71	39.01	34	45.33	105	40.86	Ns[d,e]
Heavy episodic drinking	Baseline	108	69.68	110	60.44	51	67.11	161	62.40	Ns[d,e]
	12 months	50	32.26	69	37.50	22	29.33	91	35.14	Ns[d,e]
Any alcohol problem	Baseline	155	100.00	184	100.00	76	100.00	260	100.00	–
	12 months	84	54.19	103	55.98	44	57.89	147	56.54	Ns[d,e]

Ns: non-significant.

[a] Group differences between the three study conditions and between C and I were analysed using sample survey analyses with hospital as strata and ward as primary sampling unit.

[b] Analyses were conducted twice with exchanged reference groups.

[c] Linear regression with log transformed gram alcohol.

[d] Multinomial logistic regression for C vs. IL vs. IP.

[e] Logistic regression for C vs. I.

Table 3
Outcome measures regarding motivation and well-being at baseline and at follow-up

Variables	Time	Control (C, n = 155)		Intervention Liaison (IL, n = 184)		Intervention Physician (IP, n = 76)		Any Intervention (I, n = 260)		Differences[a] C vs. IL vs. IP[b] C vs. I
Motivation (N, % yes)										
Ready to change drinking	Baseline	46	29.87	35	19.02	18	23.68	53	20.38	Ns[c,d]
	12 months	46	31.08	52	29.38	24	32.43	76	30.28	Ns[c,d]
Ready to seek help	Baseline	37	24.18	20	10.93	7	9.21	27	10.42	C > IL[*], IP[*], I[**,c,d]
	12 months	16	10.46	14	7.78	7	9.33	21	8.24	Ns[c,d]
Well-being (M, S.D.)										
Satisfaction with life	Baseline	19.44	5.50	20.33	4.75	20.59	5.44	20.41	4.95	Ns[e]
	12 months	20.77	5.41	20.82	4.96	21.48	5.87	21.01	5.23	Ns[e]
Mental health	Baseline	14.19	4.13	14.29	3.58	13.34	4.20	14.02	3.79	Ns[e]
	12 months	14.57	3.75	14.67	3.50	13.61	4.35	14.36	3.79	Ns[e]
Subjective health	Baseline	–	–	–	–	–	–	–	–	–
	12 months	3.08	0.86	3.14	0.80	3.12	0.98	3.13	0.86	Ns[e]

Ns: non-significant.

[a] Group differences between the three study conditions and between C and I were analysed using sample survey analyses with hospital as strata and ward as primary sampling unit.

[b] Analyses were conducted twice with exchanged reference groups.

[c] Multinomial logistic regression for C vs. IL vs. IP.

[d] Logistic regression for C vs. I.

[e] Linear regression.

[*] $p < 0.05$.

[**] $p < 0.01$.

Table 4
Generalized estimating equations to predict longitudinal outcomes

		Gram alcohol per day[a]	Alcohol abuse[b]	At-risk drinking[b]	Heavy episodic drinking[b]	Ready to change drinking[b]	Ready to seek help[b]	Mental health[a]	Satisfaction with life[a]
Model I									
Intervention	Coeff[a]/OR[b]	−0.09	0.94	1.05	0.72	0.60[*]	0.37[***]	−0.19	0.90
	CI 95%	−0.26, 0.09	0.59, 1.48	0.67, 1.64	0.47, 1.11	0.38, 0.95	0.21, 0.63	−0.99, 0.61	−0.26, 2.05
Time	Coeff[a]/OR[b]	−2.55[***]	0.29[***]	0.30[***]	0.21[***]	1.06	0.37[**]	0.36	1.17[*]
	CI 95%	−3.39, −1.72	0.15, 0.55	0.18, 0.48	0.13, 0.34	0.65, 1.73	0.19, 0.69	−0.39, 1.10	0.24, 2.09
Interaction	Coeff[a]/OR[b]	0.47	1.09	0.83	1.58	1.60	2.11	−0.01	−0.68
	CI 95%	−0.56, 1.49	0.48, 2.50	0.46, 1.53	0.87, 2.87	0.85, 3.02	0.88, 5.05	−0.87, 0.86	−1.80, 0.44
Model II[c]									
Intervention	Coeff[a]/OR[b]	−0.08	1.51	1.01	0.71	0.45[**,d]	0.30[***]	−0.84	0.14
	CI 95%	−0.35, 0.19	0.87, 2.63	0.61, 1.68	0.44, 1.16	0.27, 0.76	0.16, 0.58	−1.68, 0.01	−0.81, 1.09
Time	Coeff[a]/OR[b]	−2.47[***]	0.35[**]	0.25[***]	0.18[***]	0.91	0.28[**]	0.29	0.94
	CI 95%	−3.36, −1.57	0.17, 0.74	0.15, 0.44	0.11, 0.32	0.52, 1.58	0.13, 0.59	−0.52, 1.09	0.01, 1.88
Interaction	Coeff[a]/OR[b]	0.49	0.73	0.92	1.67	2.11[*]	2.90[*]	0.05	−0.55
	CI 95%	−0.60, 1.58	0.29, 1.83	0.47, 1.81	0.85, 3.29	1.03, 4.33	1.06, 7.95	−0.88, 0.97	−1.68, 0.59

[a] Linear regression.
[b] Logistic regression.
[c] Model I + hospital, gender, age, intimate partner, school, health satisfaction, TReaT, LAST.
[d] TReaT not included as covariate.
[*] $p < 0.05$.
[**] $p < 0.01$.
[***] $p < 0.001$.

future their alcohol use would decline to their average consumption.

While we did not find any intervention effects regarding alcohol consumption or well-being, we discovered positive effects of the MI based intervention regarding aspects of motivation. In contrast to a previous study (Saitz et al., 2007), 1 year after hospitalization, individuals that had received a MI based intervention showed a stronger increase of readiness to change drinking and a less profound drop of readiness to seek help than those who did not receive additional counselling. Said differently, individuals who received intervention were more likely to proceed from "not ready" to "ready" to change or to seek help, and they were less likely to relapse from "ready" to "not ready". Conclusions from this finding should be drawn with caution as the intervention groups only compensated their initial lag of motivation.

The cross-sectional analyses revealed that the physicians and the liaison service did not differ in their outcome. However, we were not able to fully answer the question of what is the most effective way of delivery—by physicians or by a liaison service. Due to the small sample size in the physician group, we were forced to combine both intervention groups for the longitudinal analyses. On account of the restructuring of one hospital and the drastically increasing numbers of readmissions towards the end of the study, we faced difficulties recruiting as many participants for the physician group as for the other two groups.

In addition to the limitations mentioned above, there are a few problems with the study itself. Firstly, to avoid mixed conditions, randomization was conducted by time-frame. This may have caused the baseline differences found among the three groups. The baseline differences regarding motivational aspects and satisfaction with health are most likely attributable to the fact that the control group was recruited first. The finding that both intervention groups included more patients who were "not ready" may be explained by the increasing experience of the study staff. By the time the intervention groups were recruited, the study staff may have had become even more skilled in recruiting patients who were not ready to change their drinking or to seek help. And as the control group was recruited first, it probably included more patients who were hospitalized repeatedly and who were excluded as re-admissions later on when the intervention groups were recruited. This suggests that the control group included more patients with severe illnesses, explaining the lower health satisfaction scores at baseline. Thus, randomization by time-frame does not seem well suited for studies lasting this long. An associated disadvantage was that the staff that conducted the assessments knew what group the participants

were in. However, as we controlled for baseline differences and as the staff was trained in conducting standardized diagnostic interviews, we hope to have reduced the possibility of the findings being the result of a biased sample or of a biased outcome assessment. Secondly, the intervention by the physicians was a "black box" as constant supervision was not possible in "real world" conditions. We cannot be sure to what extent MI-strategies were applied and how well the interventions were conducted. The substantial missing data on the contact protocol may be explained by the well-known issue regarding the lack of documentation by physicians (e.g. Seppa et al., 2004). However, as the MI-trainings were voluntary we assume that those physicians who attended the trainings were motivated to learn and to apply new strategies with persons with alcohol problems. The input we provided to the physicians in terms of training was the maximum that was possible under routine care conditions given the workload of the hospital physicians in Germany. Dealing with these problems seems to be a critical challenge when implementing BAI in general hospitals. Concluding from the physicians' low participation in our MI training program, it seems beneficial to raise their awareness of the importance of applying motivation enhancing communication skills, as these may increase motivation. Thirdly, our sample contained only 6% women. This may be explained by the use of a non-gender specific recommended AUDIT cut-off value of eight (Babor et al., 2001), which might have caused an under-representation of women with less severe alcohol problems. We decided not to drop the women from the analyses, as the study was designed to identify inpatients with an AUDIT score of 8 or higher. Fourthly, data were based on self-report only.

The strengths of this study are: (a) the large sample of inpatients with alcohol problems that do not meet criteria for alcohol dependence, (b) the inclusion of several hospitals that cover an entire geographical region, and (c) the application of a two-stage-sampling as well as the use of standardized screening and diagnostic tools. This study was the first to indicate that MI based intervention has a positive effect on readiness to change among non-dependent problem drinkers in general hospitals. Interventions that successfully enhance behaviour change motivation resolve ambivalence regarding the change and make future change more likely. Although no differences in alcohol use were found in our study, this finding is clinically relevant as it demonstrates that MI based brief interventions help to increase or maintain the patients' readiness to change and to seek help, an important premise for future behaviour change

Table 5
Cross tables for transition in motivation

		Ready to change at follow-up				Ready to seek help at follow-up			
		Control		Intervention		Control		Intervention	
		No	Yes	No	Yes	No	Yes	No	Yes
Ready at	No	83	22	147	51	111	3	212	16
Baseline	Yes	19	23	28	25	24	13	21	5
	Total, *n*	102	45	175	76	135	16	233	21

(Project MATCH Research Group, 1997). Further developments of intervention strategies are needed. For example, our intervention may have fared better if additional after care such as a one-time intervention by telephone was provided (Wilk et al., 1997; Humphreys and Tucker, 2002) to assist individuals with turning their increased motivation into actually reducing their alcohol consumption after hospital discharge.

Conflict of interest statement

All authors declare that they have no conflicts of interest.

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